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Modern aircraft transparencies often use stretched acrylic plies. Laser cutting may be used to form intricate designs from PMMA sheets. McGraw Hill Professional. Additionally, since the bases of dental prosthetics are often constructed using PMMA, adherence of PMMA denture teeth to PMMA denture bases is unparalleled, leading to the construction of a strong and durable prosthetic.[47] Artistic and aesthetic uses Lexus Perspex car sculpture PMMA art by Manfred Kielnhofer Kawai acrylic grand piano Acrylic paint essentially consists of PMMA suspended in water; however since PMMA is hydrophobic, a substance with both hydrophobic and hydrophilic groups needs to be added to facilitate the suspension. 24 (8): 350–4. ISBN 978-3038214526. (2014). "Low-modulus PMMA bone cement modified with castor oil". Retrieved 2015-03-23. ^ Kaufmann, Timothy J.; Jensen, Mary E.; Ford, Gabriele; Gill, Lena L.; Marx, William F.; Kallmes, David F. Archived from the original on 2013-01-21. (February 2010) Being transparent and durable, PMMA is a versatile material and has been used in a wide range of fields and applications such as rear-lights and instrument clusters for vehicles, appliances, and lenses for glasses. 28 (24): 1706901. ISBN 978-0-07-295358-9. The strength of the material is higher than molding grades owing to its extremely high molecular mass. "Cardiovascular Effects of Polymethylmethacrylate Use in Percutaneous Vertebroplasty". Emerging biotechnology and biomedical research use PMMA to create microfluidic lab-on-a-chip devices, which require 100 micrometre-wide geometries for routing liquids. Please help to clean it up to meet Wikipedia's quality standards. Platt (1 January 2003). Soft contact lenses are often made of a related polymer, where acrylate monomers containing one or more hydroxyl groups make them hydrophilic. ^ a b DATA TABLE FOR: Polymers: Commodity Polymers: PMMA Archived 2007-12-13 at the Wayback Machine. For the neurotoxic designer drug PMMA, commonly sold as MDMA, see para-Methoxy-N-methylamphetamine. PMMA is an important material in the making of certain lighthouse lenses.[35] PMMA was used for the roofing of the compound in the Olympic Park for the 1972 Summer Olympics in Munich. Washington, D.C.: U.S. Government Printing Office. ^ Congressional Record: Proceedings and Debates of the 77th Congress First Session (Volume 87, Part 11 ed.). Pressure is used during the curing process to minimize polymerization shrinkage, ensuring an accurate fit of the prosthesis. Retrieved 2018-11-15. Notable trade names and brands include Acrylite,[14] Lucite,[15] PerClax, R-Cast,[16] Plexiglas,[17][18] Optix,[17] Perspex,[17] Oroglas,[19] Altuglas,[20] Cyrolite,[17] Astariglas,[21] Cho Chen,[22] Sumipex, and Crystallite. p. 519. Bibcode:2014JMagR.242..233W. ^ Andersen, Hans J. It can also be used as a casting resin, in inks and coatings, and for many other purposes. PMC 7975098. ^ ^ "Cho Chen Ind. ^ Smith, William F.; Hashemi, Javad (2006). At Parkin, we're one of the UK's leading suppliers of cosplay materials and accessories so order yours online today or get in touch with our friendly team for more information. p. 341. ISBN 978-0-471-45920-0. "Saving a fragile legacy. ^ López, Alejandro; Hoess, Andreas; Thersleff, Thomas; Ott, Marjam; Engqvist, Håkan; Persson, Cecilia (2011-01-01). ^ Cappitelli, Francesca; Principi, Pamela; Sorlini, Claudia (2006). doi:10.1038/sj.embor.7400844. (2011). ^ Glaze of light Archived 2009-01-10 at the Wayback Machine, Building Design Online, June 8, 2007 ^ Robert A. Uses in dentistry Due to its aforementioned biocompatibility, poly(methyl methacrylate) is a commonly used material in modern dentistry, particularly in the fabrication of dental prosthetics, artificial teeth, and orthodontic appliances. Eyeglass lenses are commonly made from PMMA. Archived from the original on 2015-09-24. Materials Selection in Mechanical Design (3rd ed.). Meyers, "Molecular biology and biotechnology: a comprehensive desk reference", Wiley-VCH, 1995, p. Modern furniture makers, especially in the 1960s and 1970s, seeking to give their products a space age aesthetic, incorporated Lucite and other PMMA products into their designs, especially office chairs. This can lead to a higher illumination of the back part of a room, in particular when combined with a white ceiling, while having a slight impact on the view to the outside compared to normal glazing.[41][42] Medical technologies and implants PMMA has a good degree of compatibility with human tissue, and it is used in the manufacture of rigid intraocular lenses which are implanted in the eye when the original lens has been removed in the treatment of cataracts. doi:10.1177/073490402762574749. LEUKOS. 2013. The polymer separated from the glass as a clear plastic sheet, which Röhm gave the trademarked name Plexiglas in 1933.[8] Both Perspex and Plexiglas were commercialized in the late 1930s. Buchheit, T.; Minor, A.; Spolenak, R.; et al. register.dpma.de. Plastics Materials and Processes: A Concise Encyclopedia. Crazychameleonbodyartsupply.com. In orthopedic surgery, PMMA bone cement is used to affix implants and to remodel lost bone. High-heel shoes made of Lucite An electric bass guitar made from poly(methyl methacrylate) A Futuro house in Warrington, New Zealand Biodegradation The Futuro house was made of fibreglass-reinforced polyester plastic, polyester-polyurethane, and poly(methylmethacrylate); one of them was found to be degrading by cyanobacteria and Archaea.[58][59] See also Organic laser Organic photonics Polycarbonate References ^ a b c Polymethylmethacrylate (PMMA, Acrylic) Archived 2015-04-02 at the Wayback Machine. C.; Leupold, J.; Dragonu, I.; von Elverfeldt, D.; Zaitsev, M.; Wallrabe, U. Sheets of PMMA are commonly used in the sign industry to make flat cut out letters in thicknesses typically varying from 3 to 25 millimeters (0.1 to 1.0 in). (Ed.), Tunable Laser Applications (CRC, New York, 2009) Chapters 3 and 4. (2002-11-19). 23 (4): 601–4. Acrylic is also used extensively throughout the sign industry as a component of wall signs where it may be a backplate, painted on the surface or the backside, a faceplate with additional raised lettering or even photographic images printed directly to it, or a spacer to separate sign components. PMMA's advantage is that it allows for extremely high resolution patterns to be made. "Tensions in acrylics when laser cutting". ^ Reed Business Information (13 June 1974). In the United States, E.I. du Pont de Nemours & Company (now DuPont Company) subsequently introduced its own product under the trademark Lucite. About the same time, chemist and industrialist Otto Röhm of Rohm and Haas AG in Germany attempted to produce safety glass by polymerizing methyl methacrylate between two layers of glass. Scratches may easily be removed by polishing or by heating the surface of the material. These are pressure rated and satisfy stringent requirements of materials for biocompatibility, toxicity, and extractables. New Scientist. "Effects of Humidity History on the Tensile Deformation Behaviour of Poly(methyl–methacrylate) (PMMA) Films". Bio-Medical Materials and Engineering. Elsevier. ^ "Never cut these materials" (PDF). Smooth PMMA surface can be easily nanostructured by treatment in oxygen radio-frequency plasma[53] and nanostructured PMMA surface can be easily smoothed by vacuum ultraviolet (VUV) irradiation.[53] PMMA is used as a shield to stop beta radiation emitted from radioisotopes. Advanced Functional Materials. 242 (2014): 233–242. ^ "Working with Plexiglas" Archived 2015-02-21 at the Wayback Machine. 1941. Since PMMA is softer and more easily scratched than glass, scratch-resistant coatings are often added to PMMA sheets to protect it (as well as possible other functions). Transparent thermoplastic This article is about the transparent plastic sometimes called acrylic glass. ISSN 0959-2989. PMMA technology is utilized in roofing and waterproofing applications. ^ Yeang, Ken. Although sticky, it does not bond to either the bone or the implant; rather, it primarily fills the spaces between the prosthesis and the bone preventing motion. It was developed in 1928 in several different laboratories by many chemists, such as William Chalmers, Otto Röhm, and Walter Bauer, and first brought to market in 1933 by German Röhm & Haas AG (as of January 2019, part of Evonik Industries) and its partner and former U.S. affiliate Rohm and Haas Company under the trademark Plexiglas.[5] PMMA is an economical alternative to polycarbonate (PC) when tensile strength, flexural strength, transparency, polishability, and UV tolerance are more important than impact strength, chemical resistance, and heat resistance.[6] Additionally, PMMA does not contain the potentially harmful bisphenol-A subunits found in polycarbonate and is a far better choice for laser cutting.[7] It is often preferred because of its moderate properties, easy handling and processing, and low cost. Retrieved 29 June 2014. Terrypepper.com. It is less often used in other building types due to incidents such as the Summerland disaster. X-ray, Synchrotron and Neutron Techniques. ^ "Trademark Electronic Search System". It is supplied as a powder with liquid methyl methacrylate (MMA). "Biodeterioration of modern materials in contemporary collections: Can biotechnology help?". 722 ISBN 1-56081-925-1 ^ Apple, David J (2006). Co., Ltd". Exposure to these creates chain scission or (de-cross-linking) within the PMMA, allowing for the selective removal of exposed areas by a chemical developer, making it a positive photoresist. ^ Rinaldi, Andrea (2006). ^ "Filling in Wrinkles Safely". ^ a b Refractive index and related constants – Poly(methyl methacrylate) (PMMA, Acrylic glass) Archived 2014-11-06 at the Wayback Machine. ISBN 978-1-55642-786-2. Refractiveindex.info. 519 (21): 7259–63. Constructing Architecture – Materials Processes Structures, A Handbook. Rubber toughening has been used to increase the toughness of PMMA to overcome its brittle behavior in response to applied loads. Australian nail technology. Rather, it breaks into large dull pieces. Collection of Jock de Swart, Durango, CO ^ Plexiglas® Color Numbers Archived 2016-05-18 at the Portuguese Web Archive. PMC 1679785. ISBN 978-0-7506-6168-3. Acrylic Sheets are produced in dozens of standard colors,[49] most commonly sold using color numbers developed by Rohm & Haas in the 1950s. PMID 16782219. PMMA is used in the lenses of exterior lights of automobiles.[34] Spectator protection in ice hockey rinks is made from PMMA. St. Louis, Mo.: Elsevier Mosby. Perspex has been used as a surface to paint on, for example by Salvador Dalí. Some manufacturers[28] add coatings or additives to PMMA to improve absorption in the 300–400 nm range. Retrieved 2020-04-17. Historically, PMMA was an important improvement in the design of aircraft windows, making possible such designs as the bombardier's transparent nose compartment in the Boeing B-17 Flying Fortress. Construct and create to your hearts content with this comprehensive collection of thermoplastics comprising of various weights, types and uses.All designed to bring your ideas to life. Although PMMA is biologically compatible, MMA is considered to be an irritant and a possible carcinogen. ^ "DPMAregister | Marken - Registerauskunft". PMMA Laserdisc. (2013). Through the use of injection molding techniques, wax based designs with artificial teeth set in predetermined positions built on gypsum stone models of patients' mouths can be converted into functional prosthetics used to replace missing dentition. Polymethyl methacrylate was discovered in the early 1930s by British chemists Rowland Hill and John Crawford at Imperial Chemical Industries (ICI) in the United Kingdom.[citation needed] ICI registered the product under the trademark Perspex. Synthesis PMMA is routinely produced by emulsion polymerization, solution polymerization, and bulk polymerization. Acrylic prosthetic construction Pre-polymerized, powdered PMMA spheres are mixed with a Methyl Methacrylate liquid monomer, Benzoyl Peroxide (initiator), and NN-Dimethyl-P-Toluidine (accelerator), and placed under heat and pressure to produce a hardened polymerized PMMA structure. Properties Skeletal structure of methyl methacrylate, the constituent monomer of PMMA Pieces of Plexiglas(R), the windscreen of a German plane shot down during World War II PMMA is a strong, tough, and lightweight material. Chemically, it is the synthetic polymer of methyl methacrylate. ^ Kutz, Myer (2002). EMBO Reports. 62 (902): 684. Diasec is a process which uses acrylic glass as a substitute for normal glass in picture frames. doi:10.3233/BME-2012-0679. Archived from the original on 2013-10-07. ^ Symington, Jan (2006). By incorporating a polyester fleece sandwiched between two layers of catalyst-activated PMMA resin, a fully reinforced liquid membrane is created in situ. p. 509. To produce 1 kg (2.2 lb) of PMMA, about 2 kg (4.4 lb) of petroleum is needed.[citation needed] PMMA produced by radical polymerization (all commercial PMMA) is atactic and completely amorphous. www.chochen.com.tw. Bibcode:2011TSF...519.7259U. doi:10.1016/j.tsf.2011.01.136. "Thin film Cu(In,Ga)Se$_2$ solar cells processed from solution pastes with polymethyl methacrylate binder". These letters may be used alone to represent a company's name and/or logo, or they may be a component of illuminated channel letters. The reaction between methacrylic acid and methanol results in the ester methyl methacrylate. PMID 17077862. Processing The glass transition temperature (Tg) of atactic PMMA is 105 °C (221 °F). A. Methacrylate polymers are used extensively in medical and dental applications where purity and stability are critical to performance.[citation needed] Transparent glass substitute Close-up of pressure sphere of Bathyscaphe Trieste, with a single conical window of PMMA set into sphere hull. Harper; Edward M. ISBN 978-1-85957-380-8. "Modeling Attenuation versus Length in Practical Light Guides". Comonomers such as methacrylic acid can be added to increase the glass transition temperature of the polymer for higher temperature use such as in lighting applications. My Life with Jan. Bendinglight.co.uk. ^ "polymethyl methacrylate", Dorland's Illustrated Medical Dictionary, Elsevier ^ "polymethyl methacrylate". For the glass/plastic laminate often called "safety glass", see Laminated glass. The larger circular clear black area represents the larger outer side of the thick one-piece plastic cone "window". science-projects.com. Artificial nails in the "acrylic" type often include PMMA powder.[57] Some modern briar, and occasionally meerschaum, tobacco pipes sport stems made of Lucite. Artificial teeth While denture teeth can be made of several different materials, PMMA is a material of choice for the manufacturing of artificial teeth used in dental prosthetics. In the majority of applications, it will not shatter. Objects like insects or coins, or even dangerous chemicals in breakable quartz ampules, may be embedded in such "cast" blocks, for display and safe handling. P.; Kirilenko, A. ^ a b Lapshin, R. Acrylate resin casting See also: Amber Illustrative and secure bromine chemical sample used for teaching. PMMA polymer and methyl methacrylate monomer mix is then injected into a flask containing a gypsum mold of the previously designed prosthesis, and placed under heat to initiate polymerization process. Lucite beads and ornaments are still sold by jewelry suppliers. PMMA is used for viewing ports and even complete pressure hulls of submersibles, such as the Alicia submarine's viewing sphere and the window of the bathyscaphe Trieste. View as: 7 Item(s) Show 9 12 24 Sort By Position Name Price weight Colour Glitter Colour View as: 7 Item(s) Sort By Position Name Price weight Colour Glitter Colour Both Wonderflex and Worbla can be reheated and reworked, so are great for beginners looking to master their cosplay armour or weaponry. U.S. Food and Drug Administration. PMMA passes infrared light of up to 2,800 nm and blocks IR of longer wavelengths up to 25,000 nm. p. 170. Archived from the original on 21 November 2015. N verify (what is YN ?) Infobox references Chemical compound Lichtenberg figure: high-voltage dielectric breakdown in an acrylic polymer block Poly(methyl methacrylate) (PMMA) belongs to a group of materials called engineering plastics. Other uses PMMA, in the commercial form Technovit 7200 is used vastly in the medical field. ^ Polymethyl acrylate and polyethyl acrylate, Encyclopædia Britannica Archived 2007-04-28 at the Wayback Machine. ISBN 978-0864585981. Reynoldspolymer.com. Retrieved 23 December 2014. S2CID 11545416. ^ Schwarcz, Joe (6 November 2012), The Right Chemistry: 108 Enlightening, Nutritious, Health-Conscious and Occasionally Bizarre Inquiries into the Science of Daily Life, Doubleday Canada, p. 226, ISBN 978-0-385-67160-6, archived from the original on 20 April 2016 ^ "Polymethyl methacrylate | chemical compound". Makeitfrom.com. The very small black circle (smaller than the man's head) is the inner side of the plastic "window", only a few inches in diameter. The glass sample vial of the corrosive and poisonous liquid has been cast into an acrylic plastic cube Methyl methacrylate "synthetic resin" for casting (simply the bulk liquid chemical) may be used in conjunction with a polymerization catalyst such as methyl ethyl ketone peroxide (MEKP), to produce hardened transparent PMMA in any shape, from a mold. However, the pulsed lasercutting introduces high internal stresses along the cut edge, which on exposure to solvents produce undesirable "stress-crazing" at the cut edge and several millimetres deep. How Electronic Things Work... Uses This section contains embedded lists that may be poorly defined, unverified or indiscriminate. Comonomers such as butyl acrylate are often added to improve impact strength. PMID 22561251. Foundations of Materials Science and Engineering (4th ed.). G.; Odintsov, S. 21 (5–6): 323–332. INIST:14365060. ^ David K. Mechanical properties of the material allow for heightened control of aesthetics, easy surface adjustments, decreased risk of fracture when in function in the oral cavity, and minimal wear against opposing teeth. During World War II both Allied and Axis forces used acrylic glass for submarine periscopes and aircraft windscreen, canopies, and gun turrets.[9] Aeroplane pilots whose eyes were damaged by flying shards of PMMA fared much better than those injured by standard glass, demonstrating better compatibility between human tissue and PMMA than glass.[10] Civilian applications followed after the war.[11] Names Common orthographic stylings include polymethyl methacrylate[12][13] and polymethylmethacrylate. ^ Duarte, F. A blacklight-reactive tattoo ink using PMMA microcapsules has been developed.[54] PMMA can be used as a dispersant for ceramic powders to stabilize colloidal suspensions in non-aqueous media.[citation needed] Due to its high viscosity upon dissolution, it can also be used as binder material for solution deposition processes, e.g. printing of solar cells.[55] In the 1960s, luthier Dan Armstrong developed a line of electric guitars and basses whose bodies were made completely of acrylic. It enabled a light and translucent construction of the structure.[36] PMMA (under the brand name "Lucite") was used for the ceiling of the Houston Astrodome. The type of acrylic used in tanning beds is most often formulated from a special type of polymethyl methacrylate, a compound that allows the passage of ultraviolet rays. John Wiley & Sons. Non-modified PMMA behaves in a brittle manner when under load, especially under an impact force, and is more prone to scratching than conventional inorganic glass, but modified PMMA is sometimes able to achieve high scratch and impact resistance. For other uses, see Acrylic (disambiguation). Archived from the original on 2017-01-19. doi:10.1002/adfm.201706901. Though other methods of polymerizing PMMA for prosthetic fabrication exist, such as chemical and microwave resin activation, the previously described heat-activated resin polymerization technique is the most commonly used due to its cost effectiveness and minimal polymerization shrinkage. S2CID 220306943. Birkhäuser. (eds.). ^ Terry Pepper, Seeing the Light, Illumination Archived 2009-01-23 at the Wayback Machine. ^ Goodman, Robert L. ^ "Acrylite Online Shop | Cut-to-Size | Sheets | Rods | Tubes". ^ a b c d Charles A. Designers started building large aquariums when poly(methyl methacrylate) could be used. ^ Plexiglas history by Evonik (in German). Croydon, Victoria, Australia: Tertiary Press. "Vacuum ultraviolet smoothing of nanometer-scale asperities of poly(methyl methacrylate) surface". 7 (11): 1075–9. Matbase.com. ^ Altuglas International Plexiglas UF-3 UF-4 and UF-5 sheets Archived 2006-11-17 at the Wayback Machine. Thin Solid Films. It is also used for coating polymers based on MMA provides outstanding stability against environmental conditions with reduced emission of VOC. Plombage is an outdated treatment of tuberculosis where the pleural space around an infected lung was filled with PMMA balls, in order to compress and collapse the affected lung. The full IUPAC chemical name is poly(methyl 2-methylpropenoate). "Preliminary Studies on Burning Behavior of Polymethylmethacrylate (PMMA)". Engineering and High Performance Plastics Market Report: A Rapra Market Report. TESS. p. 9. It is a transparent thermoplastic. professionalplastics.com ^ Syurik, Julia; Jacucci, Gianni; Onelli, Olimpia D.; Holscher, Hendrik; Vignolini, Silvia (22 February 2018). This compatibility was discovered by the English ophthalmologist Harold Ridley in WWII RAF pilots, whose eyes had been riddled with PMMA splinters coming from the side windows of their Supermarine Spitfire fighters – the plastic scarcely caused any rejection, compared to glass splinters coming from aircraft such as the Hawker Hurricane.[43] Ridley had a lens manufactured by the Rayner company (Brighton & Hove, East Sussex) made from Perspex polymerised by ICI. ^ How Serraglaze works Archived 2009-03-05 at the Wayback Machine. Such panels have been commercialized for purposes of daylighting, to be used as a window or a canopy such that sunlight descending from the sky is directed to the ceiling or into the room rather than to the floor. Archived from the original on 21 April 2016. ^ Ashby, Michael F. It has a density of 1.17–1.20 g/cm^3,[1][26] which is less than half that of glass.[1] It also has good impact strength, higher than both glass and polystyrene; however, PMMA's impact strength is still significantly lower than polycarbonate and some engineered polymers. Where appropriate, incorporate items into the main body of the article. – Polymer Data File – PMMA". (It is a common mistake to use "an" instead of "en".) Although PMMA is often called simply "acrylic", acrylic can also refer to other polymers or copolymers containing polyacrylonitrile. Retrieved 2013-01-25. External links Perspex Technical Properties Perspex Material Safety Data Sheet (MSDS) Retrieved from " Fosshape is slightly different in that once it has been heated and cooled it can't be reworked, but it still remains a popular choice for millinery, costume making and prop making thanks to its lightweight and breathable nature.In our thermoplastic section, you'll find everything you need to start moulding and creating cosplay armour and props including heat guns, soldering irons, and thermoplastic materials such as Worbla and Wonderflex both available in sheets of varying sizes allowing you to create a huge range of cosplay outfits. The Tg values of commercial grades of PMMA range from 85 to 165 °C (185 to 329 °F); the range is so wide because of the vast number of commercial compositions which are copolymers with co-monomers other than methyl methacrylate. (2005). Petrie (10 October 2003). It is used for plastic histology, electron microscopy, as well as many more uses. J. ^ Wapler, M. PMMA swells and dissolves in many organic solvents; it also has poor resistance to many other chemicals due to its easily hydrolyzed ester groups. Police vehicles for riot control often have the regular glass replaced with PMMA to protect the occupants from thrown objects. MRS Proceedings. Nevertheless, its environmental stability is superior to most other plastics such as polystyrene and polyethylene, and therefore it is often the material of choice for outdoor applications.[29] PMMA has a maximum water absorption ratio of 0.3–0.4% by weight.[26] Tensile strength decreases with increased water absorption.[30] Its coefficient of thermal expansion is relatively high at $(5–10)\times10^{-5}$ °C^{-1}.[31] Modification of properties Pure poly(methyl methacrylate) homopolymer is rarely sold as an end product, since it is not optimized for most applications. PMMA, in a purified form, is used as the matrix in laser dye-doped organic solid-state gain media for tunable solid state dye lasers.[52] In semiconductor research and industry, PMMA aids as a resist in the electron beam lithography process. ^ Myer Ezrin Plastics Failure Guide: Cause and Prevention Archived 2016-04-21 at the Wayback Machine, Hanser Verlag, 1996 ISBN 1-56990-184-8, p. Retrieved 3 August 2020. A solution consisting of the polymer in a solvent is used to spin coat silicon and other semiconducting and semi-insulating wafers with a thin film. Acrylite.co. US Patent and Trademark Office. PMMA ignites at 460 °C (860 °F) and burns, forming carbon dioxide, water, carbon monoxide, and low-molecular-weight compounds, including formaldehyde.[27] PMMA transmits up to 92% of visible light (3 mm thickness), and gives a reflection of about 4% from each of its surfaces due to its refractive index (1.4905 at 589.3 nm).[3] It filters ultraviolet (UV) light at wavelengths below about 300 nm (similar to ordinary window glass). February 28, 2015. Plasticizers may be added to improve processing properties, lower the glass transition temperature, improve impact properties, and improve mechanical properties such as elastic modulus [32] Dyes may be added to give color for decorative applications, or to protect against (or filter) UV light. Retrieved 8 December 2015. Archived from the original on 20 April 2016. Retrieved 2017-05-22. Sir Harold Ridely and His Fight for Sight: He Changed the World So That We May Better See It. Thorofare NJ USA: Slack. OCLC 773020864.{{cite book}}: CS1 maint: others (link) ^ de Swart, Ursula. ^ – Blacklight Tattoo Ink – Blacklight Tattoo Ink FAQ Archived 2012-01-04 at the Wayback Machine. ISBN 9780071429245. (2010). Ibanezregister.com. ^ Uhl, Alexander R.; Romanyuk, Yaroslav E.; Tiwari, Ayodhya N. 20 (4): 297–317. doi:10.1134/S1027451010010015. "Magnetic properties of materials for MR engineering, micro-MR and beyond". Daylight redirection Main article: Anidolic lighting Laser cut acrylic panels have been used to redirect sunlight into a light pipe or tubular skylight and, from there, to spread it into a room.[37] Their developers Veronica Garcia Hansen, Ken Yeang, and Ian Edmonds were awarded the Far East Economic Review Innovation Award in bronze for this technology in 2003.[38][39] Attenuation being quite strong for distances over one meter (more than 90% intensity loss for a 3000 K source[40]), acrylic broadband light guides are then dedicated mostly to decorative uses. doi:10.1016/j.tibtech.2006.06.001. "Bio-inspired Highly Scattering Networks via Polymer Phase Separation". Ludwig-Musser makes a line of acrylic drums called Vistalites, well known as being used by Led Zeppelin drummer John Bonham. Poly(methyl methacrylate) Names IUPAC name Poly(methyl 2-methylpropenoate) Other names Poly(methyl methacrylate)PMMAMethyl methacrylate resinPerspex Identifiers CAS Number 9011-14-7 Y 3D model (JSmol) Interactive image ChemSpider None ECHA InfoCard 100.112.313 KEGG C19504 N CompTox Dashboard (EPA) DTXSID1042152 SMILES CCC(C)(C(=O)OC)CC(C)(C(=O)OC)CC(C)(C(=O)OC)CC(C)(C(=O)OC)CC(C)(C(=O)OC)C Properties Chemical formula $(C_5O_2H_8)_n$ Molar mass Varies Density 1.18 g/cm^3[1] Melting point 160 °C (320 °F; 433 K)[4] Magnetic susceptibility (χ) -9.06×10^{-6} (SI, 22 °C)[2] Refractive index (nD) 1.4905 at 589.3 nm[3] Except where otherwise noted, data are given for materials in their standard state (at 25 °C [77 °F], 100 kPa). Archived from the original on 2017-10-31. ISSN 0262-4079. Ibanez[56] and B.C. Rich have also made acrylic guitars. ^ Hydrosight. PMMA has also been linked to cardiopulmonary events in the operating room due to hypotension.[45] Bone cement acts like a grout and not so much like a glue in arthroplasty. IPC Magazines. And What to do When They Don't. K. arXiv:1403.4760. (2002). Biotechnology and microbiology are increasingly used to preserve and restore the world's cultural heritage". In cosmetic surgery, tiny PMMA microspheres suspended in some biological fluid are injected as a soft-tissue filler under the skin to reduce wrinkles or scars permanently.[46] PMMA as a soft-tissue filler was widely used in the beginning of the century to restore volume in patients with HIV-related facial wasting. Pairs of acrylic sheets with a layer of microreplicated prisms between the sheets can have reflective and refractive properties that let them redirect part of incoming sunlight in dependence on its angle of incidence. ^ JS2K-PLT Archived 2007-09-28 at the Wayback Machine. Fillers may be added to improve cost-effectiveness. Handbook of Materials Selection. Even ammonium-based glass-cleaner and almost everything short of soap-and-water produces similar undesirable crazing, sometimes over the entire surface of the cut parts, at great distances from the stressed edge.[25] Annealing the PMMA sheet/parts is therefore an obligatory post-processing step when intending to chemically bond lasercut parts together. ^ Prosthodontic treatment for edentulous patients : complete dentures and implant-supported prostheses. Poly(methyl acrylate) Main article: Poly(methyl acrylate) The polymer of methyl acrylate, PMA or poly(methyl acrylate), is similar to poly(methyl methacrylate), except for the lack of methyl groups on the backbone carbon chain.[33] PMA is a soft white rubbery material that is softer than PMMA because its long polymer chains are thinner and smoother and can more easily slide past each other. 1 (4): 47–59. (George Albert), 1938- (13th ed.). 168 ^ Ishiyama, Chiemi; Yamamoto, Yoshito; Higo, Yakichi (2005). ^ Zeng, W. PMMA was used in Laserdisc optical media.[51] (CDs and DVDs use both acrylic and polycarbonate for impact resistance). Merriam-Webster Dictionary. PMMA is a widely used material to create deal toys and financial tombstones. For example, A small amount of acrylate comonomers are routinely used in PMMA grades destined for heat processing, since this stabilizes the polymer to depolymerization ("unzipping") during processing. p. 11. PMMA is thus an organic glass at room temperature; i.e., it is below its Tg. The forming temperature starts at the glass transition temperature and goes up from there.[23] All common molding processes may be used, including injection molding, compression molding, and extrusion. In the 1950s and 1960s, Lucite was an extremely popular material for jewelry, with several companies specialized in creating high-quality pieces from this material. It is used as a light guide for the backlights in TFT-LCDs.[citation needed] Plastic optical fiber used for short-distance communication is made from PMMA, and perfluorinated PMMA, clad with fluorinated PMMA, in situations where its flexibility and cheaper installation costs outweigh its poor heat tolerance and higher attenuation over glass fiber. Colored PMMA varieties allow specific IR wavelengths to pass while blocking visible light (for remote control or heat sensor applications, for example). hdl:10397/31946. PMMA is used illegally to shape muscles by some bodybuilders. Retrieved 2012-05-09. American Journal of Neuroradiology. PMMA is also known as acrylic, acrylic glass, perspex, or plexiglass, as well as by the trade names and brands Crylux, Plexiglas, Acrylite, Astariglas, Lucite, Perclax, and Perspex, among several others (see below). doi:10.1016/j.jmr.2014.02.005. R.; Li, S. V.; Alekhin, A. Journal of Fire Sciences. McGraw-Hill. Such panels act as miniature light shelves. These instruments were marketed under the Ampeg brand. ^ Deplazes, Andrea, ed. Zarb, George A. Journal of Surface Investigation. PMMA vaporizes to gaseous compounds (including its monomers) upon laser cutting, so a very clean cut is made, and cutting is performed very easily. (2002-04-01). Generally, radical initiation is used (including living polymerization methods), but anionic polymerization of PMMA can also be performed. pp. A2300–A2302. p. Search for Registration Number 0350093. The optical properties of PMMA change as the gamma dose increases, and can be measured with a spectrophotometer. Trends in Biotechnology. As early as 1939, Los Angeles-based Dutch sculptor Jan De Swart experimented with samples of Lucite sent to him by DuPont; De Swart created tools to work the Lucite for sculpture and mixed chemicals to bring about certain effects of color and refraction.[48] From approximately the 1960s onward, sculptors and glass artists such as Jan Kubíček, Leroy Lamis, and Frederick Hart began using acrylics, especially taking advantage of the material's flexibility, light weight, cost and its capacity to refract and filter light. "Acrylic vs. The highest quality PMMA sheets are produced by cell casting, but in this case, the polymerization and molding steps occur concurrently. "Salon management". Handling, cutting, and joining PMMA can be joined using cyanoacrylate cement (commonly known as superglue), with heat (welding), or by using chlorinated solvents such as dichloromethane or trichloromethane[24] (chloroform) to dissolve the plastic at the joint, which then fuses and sets, forming an almost invisible weld. This plastic is often used in sheet form as a lightweight or shatter-resistant alternative to glass. Encyclopædia Britannica. Smithers Rapra. This is done for its relatively low cost, light weight, shatter-resistance, aesthetics and because it can be ordered in larger sizes than standard picture framing glass. A disadvantage of this bone cement is that it heats up to 82.5 °C (180.5 °F) while setting that may cause thermal necrosis of neighboring tissue. JMR. Polycarbonate: A quantitative and qualitative comparison". Light Pipes: An Innovative Design Device for Bringing Natural Daylight and Illumination into Buildings with Deep Floor Plan Archived 2009-03-05 at the Wayback Machine, Nomination for the Far East Economic Review Asian Innovation Awards 2003 ^ Lighting up your workplace – Queensland student pipes light to your office cubicle Archived 2009-01-05 at the Wayback Machine, May 9, 2005 ^ Kenneth Yeang Archived 2008-09-25 at the Wayback Machine, World Cities Summit 2008, June 23–25, 2008, Singapore ^ Gerchikov, Victor; Mossman, Michele; Whitehead, Lorne (2005). 875: O12.7. doi:10.1557/PROC-875-O12.7. ^ "Tangram Technology Ltd. PMMA has been used to create ultra-white opaque membranes that are flexible and switch appearance to transparent when wet.[50] Acrylic is used in tanning beds as the transparent surface that separates the occupant from the tanning bulbs while tanning. PMID 24705364. Retrieved 2021-09-29. Bioprocess chromatography columns use cast acrylic tubes as an alternative to glass and stainless steel. L.; Krotkov, V. Archived from the original on 2010-04-21. Patterns on this can be made by an electron beam (using an electron microscope), deep UV light (shorter wavelength than the standard photolithography process), or X-rays. Many other products (for example, guitars) are sometimes made with acrylic glass to make the commonly opaque objects translucent. "Misused materials stoked Sumerland fire". ^ "R-Cast® a Brief History". History The first acrylic acid was created in 1843. In 1936 ICI Acrylics (now Lucite International) began the first commercially viable production of acrylic safety glass. ISBN 9780323078443. Methacrylic acid, derived from acrylic acid, was formulated in 1865. PMID 11950651. 10-meter (33-foot) deep Monterey Bay Aquarium tank has acrylic windows up to 33 centimeters (13 inches) thick to withstand the water pressure PMMA is commonly used for constructing residential and commercial aquariums. A careful balance of initiators and monomers is needed to reduce the rate of polymerization, and thus the heat generated. Rather, modified formulations with varying amounts of other comonomers, additives, and fillers are created for uses where specific properties are required. 4 (1): 1–11. Plexiglas.com. On 29 November 1949 at St Thomas' Hospital, London, Ridley implanted the first intraocular lens at St Thomas's Hospital in London.[44] In particular, acrylic-type contact lenses are useful for cataract surgery in patients that have recurrent ocular inflammation (uveitis), as acrylic material induces less inflammation. S2CID 97385151. ^ "WIPO Global Brand Database". PMMA in the form of sheets affords to shatter resistant panels for building windows, skylights, bulletproof security barriers, signs & displays, sanitary ware (bathtubs), LCD screens, furniture and many other applications. Historically, hard contact lenses were frequently made of this material. doi:10.1582/LEUKOS.01.04.003. ISBN 978-0-471-35924-1. Retrieved 2014-10-27. Archived from the original on 8 December 2015. These small geometries are amenable to using PMMA in a biochip fabrication process and offers moderate biocompatibility. S2CID 97589855. F.; Chow, W. Small strips of PMMA are used as dosimeter devices during the Gamma Irradiation process. Although not a type of familiar silica-based glass, the substance, like many thermoplastics, is often technically classified as a type of glass, in that it is a non-crystalline vitreous substance—hence its occasional historic designation as acrylic glass.

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