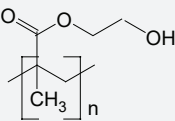
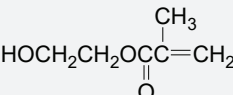


# PHEMA poly(2-hydroxyethyl methacrylate)

| PARAMETER                              | UNIT                              | VALUE  | REFERENCES  |
|--|-----------------------------------|--|---|
| <b>GENERAL</b>                         |                                   |  |   |
| Common name                            | -                                 | poly(2-hydroxyethyl methacrylate)  |   |
| Acronym                                | -                                 | PHEMA  |   |
| CAS number                             | -                                 | 25249-16-5   |   |
| Formula                                |                                   |                                 |   |
| <b>HISTORY</b>                         |                                   |  |   |
| Person to discover                     | -                                 | Lim, D   |   |
| Date                                   | -                                 | 1955   |   |
| Details                                | -                                 | Lim, working for inventor of contact lenses (Otto Wichterle) synthesized PHEMA which was used for contact lenses |   |
| <b>SYNTHESIS</b>                       |                                   |  |   |
| Monomer(s) structure                   | -                                 |                                 |   |
| Monomer(s) CAS number(s)               | -                                 | 868-77-9   |   |
| Monomer(s) molecular weight(s)         | dalton, g/mol, amu                | 130.1  |   |
| Monomer(s) expected purity(ies)        | %                                 | 99   |   |
| Monomer ratio                          | -                                 | 100%   |   |
| Method of synthesis                    | -                                 | solution polymerization with AIBN or AMBN as initiator COBF as transfer agent                                    | Jackson, A T; Thalassinos, K; John, R O; McGuire, N; Freeman, D; Scrivens, J H, Polymer, 51, 1418-24, 2010. |
| Mass average molecular weight, $M_w$   | dalton, g/mol, amu                | 20,000-1,000,000   |   |
| Molar volume at 298K                   | cm <sup>3</sup> mol <sup>-1</sup> | calc.=106.7  |   |
| Van der Waals volume                   | cm <sup>3</sup> mol <sup>-1</sup> | 71.04  |   |
| <b>STRUCTURE</b>                       |                                   |  |   |
| Crystallinity                          | %                                 | amorphous  |   |
| Entanglement molecular weight          | dalton, g/mol, amu                | calc.=13,918   |   |
| <b>PHYSICAL PROPERTIES</b>             |                                   |  |   |
| Density at 20°C                        | g cm <sup>-3</sup>                | 1.15   |   |
| Color                                  | -                                 | white  |   |
| Refractive index, 20°C                 | -                                 | calc.=1.4898-1.4973; exp.=1.5119   |   |
| Decomposition temperature              | °C                                | 299; 330 (thermal analysis)  |   |
| Thermal expansion coefficient, 23-80°C | °C <sup>-1</sup>                  | 3.7E-4   |   |
| Thermal conductivity, melt             | W m <sup>-1</sup> K <sup>-1</sup> | 0.1666   |   |

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| PARAMETER                                      | UNIT  | VALUE   | REFERENCES  |
|--|---|---|---|
| Glass transition temperature                   | °C  | 85-100 (atactic); 31 (isotactic); 109 (syndiotactic)                              |   |
| Hildebrand solubility parameter                | MPa <sup>0.5</sup>                                  | calc.=18.45   |   |
| Surface tension                                | mN m <sup>-1</sup>                                  | calc.=38.4-42.8; exp.=28.8  |   |
| Diffusion coefficient of water vapor           | cm <sup>2</sup> s <sup>-1</sup><br>x10 <sup>6</sup> | 0.59-5.37   |   |
| Contact angle of water, 20°C                   | degree  | 68.2  | Lai, S; Hudiono, Y; Lee, L J; Dauner, S; Madou, M J, Antec, 2703-7, 2002.   |
| Surface free energy                            | mJ m <sup>-2</sup>                                  | 35.4-36.0   |   |
| <b>MECHANICAL &amp; RHEOLOGICAL PROPERTIES</b> |   |   |   |
| Poisson's ratio                                | -   | 0.357   |   |
| <b>CHEMICAL RESISTANCE</b>                     |   |   |   |
| Alcohols                                       | -   | poor  |   |
| Alkalis  | -   | poor  |   |
| Esters   | -   | poor  |   |
| ⊖ solvent, ⊖-temp.=15.8, 32.1, 15.3°C          | -   | ethanol, n-propanol, water  |   |
| Good solvent                                   | -   | DMF, methanol, methyl cellosolve  |   |
| <b>TOXICITY</b>                                |   |   |   |
| HMIS: Health, Flammability, Reactivity rating  | -   | 2/1/0   |   |
| Carcinogenic effect                            | -   | not listed by ACGIH, NIOSH, NTP   |   |
| <b>PROCESSING</b>                              |   |   |   |
| Typical processing methods                     | -   | initiated chemical vapor deposition   | Bose, R K; Lau, K K S, Thin Solid Films, in press, 2011.  |
| Applications                                   | -   | contact lenses, pharmaceutical capsules, polymer electrolytes, tissue engineering | Rajan, A; Crugnola, A, Antec, 3640-43, 2002.  |
| <b>BLENDS</b>                                  |   |   |   |
| Suitable polymers                              | -   | PANI, PDMS, PHA, PHB, PCL, PLA, PU, PVP   |   |
| <b>ANALYSIS</b>                                |   |   |   |
| FTIR (wavenumber-assignment)                   | cm <sup>-1</sup> /-                                 | C=O (free) – 1730; C=O (H-bonded) – 1703, 3536                                    | Tang, Q; Yu, J-R; Chen, L; Zhu, J; Hu, Z-M, Current Appl. Phys., 11, 945-50, 2011; Morita, S; Kitagawa, K; Ozaki, Y, Vibrational Spectroscopy, 51, 28-33, 2009. |