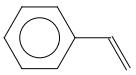
# SEBS styrene-ethylene-butylene-styrene triblock copolymer

| PARAMETER | UNIT | VALUE | REFERENCES |
|---|---|---|---|
| **GENERAL** | | | |
| **Common name** | - | styrene-ethylene-butylene-styrene triblock copolymer | |
| **CAS name** | - | styrene-butadiene rubber, hydrogenated, block, triblock | |
| **Acronym** | - | SEBS | |
| **CAS number** | - | 308076-28-0 | |
| | | | |
| **SYNTHESIS** | | | |
| **Monomer(s) structure** | - |  $H_2C{=}CHCH{=}CH_2$ | |
| **Monomer(s) CAS number(s)** | - | 100-42-5; 74-85-1; 106-98-9 | |
| **Monomer(s) molecular weight(s)** | dalton, g/mol, amu | 104.15; 28.05; 56.11 | |
| **Polystyrene content** | % | 13-60 | |
| **Polystyrene block Mw** | | 72,000 | Chang, Y-W; Shin, J-Y; Ryu, S H, Polym. Int., 53, 1047-51, 2004. |
| **Ethylene/butylene block Mw** | | 37,500 | |
| **Number average molecular weight, $M_n$** | dalton, g/mol, amu | 50,000-154,000 | Xu, W; Cheng, Z; Zhang, Z; Zhang, L; Zhu, X, Reactive Functional Polym., 71, 634-40, 2011. |
| **Mass average molecular weight, $M_w$** | dalton, g/mol, amu | 57,000-183,000 | Rungswang, W; Kotaki, M; Shimojima, T; Kimura, G; Sakurai, S; Chirachanchai, S, Polymer, 52, 844-53, 2011. |
| **Polydispersity, $M_w/M_n$** | - | 1.05 | |
| | | | |
| **STRUCTURE** | | | |
| **Lamellae thickness** | nm | 17.7-25.9 | Rungswang, W; Kotaki, M; Shimojima, T; Kimura, G; Sakurai, S; Chirachanchai, S, Polymer, 52, 844-53, 2011. |
| | | | |
| **COMMERCIAL POLYMERS** | | | |
| **Some manufacturers** | - | Elasto; Kraton Polymers | |
| **Trade names** | - | Dryflex; Kraton | |
| | | | |
| **PHYSICAL PROPERTIES** | | | |
| **Density at 20°C** | g $cm^{-3}$ | 0.88-0.95 | |
| **Bulk density at 20°C** | g $cm^{-3}$ | 0.3-0.4 | |
| **Glass transition temperature** | °C | -53 to -60; -36 (EB); 100 (ST) | Chang, Y-W; Shin, J-Y; Ryu, S H, Polym. Int., 53, 1047-51, 2004. |
| **Long term service temperature** | °C | -50 to 125 | |
| **Diffusion coefficient of oxygen** | $cm^2\ s^{-1}$ x$10^6$ | 0.1-0.12 | |
| **Contact angle of water, 20°C** | degree | 61 | Peinado, C; Corrales, T; Catalina, F; Pedron, S; Quiteria, V R S; Parellada, M D; Barrio, J A; Olmos, D; Gonzalez-Benito, J, Polym. Deg. Stab., 95, 975-86, 2010. |
| | | | |
| **MECHANICAL & RHEOLOGICAL PROPERTIES** | | | |
| **Tensile strength** | MPa | 3-40 | |
| **Tensile modulus** | MPa | 0.2-5.4 | |

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| **Tensile stress at yield** | MPa | 5.6 | |
| **Elongation** | % | 470-880 | |
| **Flexural modulus** | MPa | 100-700 | |
| **Tear strength** | kN $m^{-1}$ | 21-55 | |
| **Izod impact strength, notched, 23°C** | J $m^{-1}$ | NB | |
| **Compression set, 72h 23°C** | % | 16-20 | |
| **Shore A hardness** | - | 30-95 | |
| **Shrinkage** | % | 1.2-3 | |
| **Brittleness temperature (ASTM D746)** | °C | -60 to -21 | |
| **Melt index, 230°C/5 kg** | g/10 min | 1-22 | |
| | | | |
| **CHEMICAL RESISTANCE** | | | |
| **Acid dilute/concentrated** | - | good | |
| **Alcohols** | - | good | |
| **Aliphatic hydrocarbons** | - | poor | |
| **Aromatic hydrocarbons** | - | poor | |
| **Greases & oils** | - | good | |
| **Halogenated hydrocarbons** | - | poor | |
| | | | |
| **WEATHER STABILITY** | | | |
| **Excitation wavelengths** | nm | 290 | Luengo, C; Allen, N S; Edge, M; Wilkinson, A; Parellada, M D; Barrio, J A; Santa, V R, Polym. Deg. Stab., 91, 947-56, 2006. |
| **Emission wavelengths** | nm | 420, 450, 470 | Luengo, C; Allen, N S; Edge, M; Wilkinson, A; Parellada, M D; Barrio, J A; Santa, V R, Polym. Deg. Stab., 91, 947-56, 2006. |
| **Important initiators and accelerators** | - | formation of OH was 3-4 greater at 55ºC than 30ºC and increased humidity also accelerated its formation | White, C C; Tan, K T; Huston, D L; Nguyen, T; Benatti, D J; Stanley, D; Chin, J W, Polym. Deg. Stab., 96, 1104-1110, 2011. |
| **Important initiators and accelerators** | - | titanium traces | Luengo, C; Allen, N S; Wilkinson, A; Edge, M; Parellada, M D; Barrio, J A; Santa, V R, J. Vinyl Addit. Technol., 12, 2-7, 2006. |
| **Products of degradation** | - | hydroperoxides, acetophenone, oxidation products, discoloration, chain scission | Luengo, C; Allen, N S; Wilkinson, A; Edge, M; Parellada, M D; Barrio, J A; Santa, V R, J. Vinyl Addit. Technol., 12, 2-7, 2006. |
| **Stabilizers** | - | hindered phenols and phosphites | Luengo, C; Allen, N S; Wilkinson, A; Edge, M; Parellada, M D; Barrio, J A; Santa, V R, J. Vinyl Addit. Technol., 12, 2-7, 2006. |
| | | | |
| **TOXICITY** | | | |
| **NFPA: Health, Flammability, Reactivity rating** | - | 0/1/0 | |
| **Carcinogenic effect** | - | not listed by ACGIH, NIOSH, NTP | |
| **Oral rat, $LD_{50}$** | mg $kg^{-1}$ | >2,000 | |
| **Skin rabbit, $LD_{50}$** | mg $kg^{-1}$ | >2,000 | |

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| **ENVIRONMENTAL IMPACT** | | | |
| **Aquatic toxicity, *Daphnia magna*, $LC_{50}$, 48 h** | mg $l^{-1}$ | >1,000 | |
| **Aquatic toxicity, *Bluegill sunfish*, $LC_{50}$, 48 h** | mg $l^{-1}$ | >1,000 | |
| | | | |
| **PROCESSING** | | | |
| **Typical processing methods** | - | compounding, injection molding | |
| **Preprocess drying: temperature/ time/residual moisture** | °C/h/% | 52-80/0-3/0.04 | |
| **Processing temperature** | °C | 170-230 | |
| **Processing pressure** | MPa | 4-53 (injection); 0.3-3.5 (back) | |
| **Applications** | - | appliances, adhesives, automotive (bumper, exterior parts and trim, interior parts), belts, cable jacketing, coatings, compatibilizer, electrical/electronic, footwear, gaskets, household goods, impact modifier, medical, modifier (plastics, bitumen), piping, sealants, sporting goods, tools, toys, wheels for office furniture | |
| **Outstanding properties** | - | chemical resistance, weather resistance | |
| | | | |
| **BLENDS** | | | |
| **Suitable polymers** | - | EVA, HDPE, HIPS, PA6, PA66, PAN, PE, PP, PPS, PPy, sPS, PVDF, SIS | |
| | | | |
| **ANALYSIS** | | | |
| **FTIR (wavenumber-assignment)** | $cm^{-1}$/- | $CH_3$ – 1379; $CH_2$ – 1460; C=O – 1711; ester – 1733; lactone – 1775; OH – 3150, 3600 | White, C C; Tan, K T; Huston, D L; Nguyen, T; Benatti, D J; Stanley, D; Chin, J W, Polym. Deg. Stab., 96, 1104-1110, 2011. |
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