Accepted Manuscript

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PII: S0141-3910(18)30195-2

DOI: 10.1016/j.polymdegradstab.2018.06.003

Reference: PDST 8568

To appear in: *Polymer Degradation and Stability*

Received Date: 30 March 2018

Revised Date: 30 May 2018

Accepted Date: 4 June 2018

Please cite this article as: Pomes B, Derue I, Lucas A, Nguyen Jean-Franç, Richaud E, Water ageing of urethane dimethacrylate networks, *Polymer Degradation and Stability* (2018), doi: 10.1016/j.polymdegradstab.2018.06.003.

WATER AGEING OF URETHANE DIMETHACRYLATE NETWORKS

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ABSTRACT

This work explores the process of water ageing of high-temperature high-pressure polymerized urethane dimethacrylate (UDMA) networks. UDMA samples polymerized under several pressures (0.1 to 300 MPa) and differing by the conversion degree of polymerization were aged in water at 37, 50 and 70°C and followed by gravimetry. Diffusion was observed to obey Fick's law. The diffusion coefficient and water maximal uptake were observed to be almost independent of polymerization pressure, consistently with analysis of Dynamic Vapor Sorption data suggesting that external polymerization pressure has no effect on polymer affinity with water. This was ascribed to the fact that all materials have the same cohesive energy, as confirmed by ultrasonic measurements of elastic moduli. Polymerization pressure (used to improve conversion degree and mechanical properties) would thus have a minor influence on water ageing that is mainly triggered by polymer chemistry. When elevating the polymerization pressure, there is hence no compromise between the optimization of thermo-mechanical properties and the resistance to water ageing.

KEYWORDS: Urethane Dimethacrylate (UDMA), Water aging, Diffusion, Dynamic Vapor Sorption