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ABSTRACT:

Thermal Ageing of Fluorosilicone rubbers

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Fluorosilicones are a specific class of elastomers with improved thermal stability together with enhanced resistance to apolar solvents and fuels. Many papers deal with very high temperature ageing monitored in situ by TGA [1], together with analysis of volatile compounds which are helpful to analyze the mechanisms involved. However, rubber failure in service conditions mainly originate from changes in elastically active chains concentration, with possible heterogeneities due to Diffusion Limited Oxidation [2].

This paper will first deal with the thermal aging of commercial fluorosilicone rubber at 200, 220, and 250 °C under air and nitrogen with a focus on macromolecular changes, specifically crosslinking and chain scission. Under nitrogen, chain scission is evidenced by an increased soluble fraction, higher swelling ratio in ethyl acetate, and decreased stiffness, characterized by tensile tests. In an oxidative environment, a significant crosslinking process was evidenced, but is also accompanied by the presence of a soluble fraction increased over time. The anlaysis of those phenomena led to discuss chemical mechanisms of the FSR degradation at high temperatures.

This presentation also investigates potential heterogeneities throughout the material thickness explaning differences in the thermo-oxidative aging of thin and thick samples. Weight loss, density, and swelling tests, were conducted. Micro-indentation revealed significant information about the stiffness profile through the thickness of aged samples and included comparisons with samples aged under air and nitrogen.

[1] D.K. Thomas, Polymer, 13, 479, 1972.
[2] M. Celina, J. Wise, D.K. Ottesen, et al, Polym. Degrad. Stab., 60, 493 (1998).

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