19th International Conference on Advanced
Computational Engineering and Experimenting
29 JUNE – 3 JULY 2026 | RHODES, GREECE

ABSTRACT:

Thermal Resistance of POSS Filled-Fluoroelastomers

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Fluoroelastomers (FKM) find application in a variety of industries, including the automotive and aeronautic sectors. The materials are required to exhibit both high temperature properties and chemical resistance. With regard to the thermal resistance, it is recommended that a peroxide curing of FKM should be undertaken, with the addition of a multifunctional organic molecule, namely TAIC [1]. This results in a crosslinked rubber with TAIC serving as the crosslink node. However, TAIC has been identified as the thermal weak point of this system during thermo-oxidative aging at 250°C [2]. In order to enhance the thermal resistance of FKM, the incorporation of Polyhedral Oligomeric SilSesquioxanes (POSS) nanofillers is being considered in this study. Two distinct nanofillers are studied: octa-functional POSS acrylate (Oa-POSS) or octavinyl-POSS (Ov-POSS).

The aim here is to understand how these nanofillers integrate into the previously defined structure and their involvement in the thermal resistance of the fluoroelastomer. Initially, it was determined whether the reaction mechanisms leading to the crosslinking of FKM were modified by the addition of Oa-POSS or Ov-POSS. Subsequently, the structure of these nanocomposites was characterised using thermomechanical analyses, with the amount of nanofillers varying. Finally, the thermal degradation of the materials was investigated by thermogravimetric analysis (TGA) and compared to that of FKM. This allowed us to show that POSS do not participate in the elastomer network, but rather facilitate the retardation of the degradation of the system's cross-linking node.

[1] Ikeda, Y.; Yasuda, Y.; Ijikata, K.; Tosaka, M.; Kohjiya S., Macromolecules, 41, 5876 (2008).
[2] A. Simon, J. Pepin, D. Berthier, S. Méo, Polym. Deg. Stab., 208, 110271 (2023).