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Durability of Elastomers

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The durability of polymers is a topic of interest to all users. If many mechanisms govern the durability such as fatigue or chemical ageing, it is well known that elastomers are particularly sensitive to ageing in service due to the high intrinsic mobility and chemical instabilities of the material. It is therefore necessary to be able to propose methods for predicting the long-term mechanical behavior of these materials. The presentation will first highlight the limitations of classical approaches based on time/temperature extrapolations via an Arrhenian description of the decrease in mechanical properties over time. Then, in a second step, we will present an alternative methodology based on non-empirical approaches. This methodology consists in describing the chemical mechanisms of degradation and their consequences on the macromolecular network using kinetic considerations. Then we use relationships between the macromolecular structure of the elastomer and its mechanical properties to be able to make reliable predictions. Several examples will be proposed to illustrate the proposed approach [1, 2].

[1] Bardin, A., Le Gac, P. Y., Cérantola, S., Simon, G., Bindi, H., & Fayolle, B. (2020). Hydrolytic kinetic model predicting embrittlement in thermoplastic elastomers. *Polymer Degradation and Stability*, 171, 109002.

[2] Le Gac, P. Y., Albouy, P. A., Fayolle, B., & Verdu, J. (2021). Relationship between macromolecular network and fatigue properties of unfilled polychloroprene rubber. *Polymer Degradation and Stability*, 192, 109669.