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Synthesis of Acrylate Copolymer to Develop an Industrially Relevant Reprocessable Vitrimeric Elastomer.

Giusi Merola[1,2,3*], Christine Elian[1], Gaétan Grimaldi D'Esdra[2], Laina Guo[2], Evelyne Van Ruymbeke[3], Nathan Van Zee[1], Renaud Nicolaÿ[1]

[1] École Supérieure de Physique et de Chimie Industrielles, Université PSL (Paris Sciences & Lettres), 10 Rue Vauquelin, 75005 Paris, France

[2] Research & Innovation Center, Hutchinson, Rue Gustave Nourry, 45120 Châlette-sur-Loing, France

[3] Bio and Soft Matter (BSMA), IMCN, UCLouvain, 1348 Louvain-La-Neuve, Belgium

*giusi.merola@espci.fr

Alkylic acrylate copolymers (ACM) are elastomers used in many different industries, such as automotive, aerospace, petrochemical, energy, and construction, because of their highly elastic properties and excellent chemical, oil and abrasion resistance [1]. Like other types of thermosets, these elastomers are cross-linked during curing, resisting permanent deformation and displaying high mechanical properties, suitable for harsh environments. In an era more and more concerned about sustainability, the non-recyclability of these materials represents a major trade-off. Previous studies showed promising reprocessability of elastomers through a dual network of static and dynamic crosslinks[2]. The aim of our project is to adapt a similar approach for a high molecular weight elastomer, combining a traditional static cross linker with new dynamic ones. The first step consists in a model study where a model elastomer is synthesized through free radical polymerization (FRP), and its cross-linked properties are compared to the industrial one. In a second step, a similar FRP protocol will be used to prepare a precursor vitrimer to be mixed with both the industrial and the model elastomer. These materials will be cured with different ratios of static/dynamic cross-linkers. The two approaches and the two formulas will be compared based on a combination of mechanical, thermal and rheological characterization. The outcome will provide a possible solution to the reprocessability issue of high molecular weight, industrially-relevant elastomers.

References:
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[2] Breuillac A., Kassalias A., Nicolaÿ R., Macromolecules. ***2019*** *52, 7102-7113*