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# ADVANCED MULTI-SCALE MODELING OF POLYMER COMPOSITES

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## ABSTRACT

Polymer composites demonstrate outstanding mechanical properties such as an increased strength, stiffness or fracture toughness while keeping limited mass densities. Therefore, this class of composites shows great potential for structural applications. Despite these benefits, the wide-scale use of polymer composites is still hampered by difficulties in predicting and understanding their mechanical behavior arising from complex microstructural phenomena.

Aiming at filling this gap, multi-scale modelling techniques, more than ever, proofed capable of giving deeper insights of polymer composites mechanics in recent years. Typically, multi-scale models integrate the microstructural morphology of the composite along with the deformation processes and mechanisms at the microscopic level. This usually involves Representative Volume Elements (RVEs), local constitutive relationships of the constituents and a scale-transition technique ensuring a proper connection between the local mechanisms and the overall response of composites.

The objective of this Invited Session (IS) is to highlight the latest developments related to the multi-scale modeling approaches that are dedicated to polymer composites. In this regard, contributions dealing with the following aspects are particularly welcome:

- Mean-field multi-scale approaches for non-linear materials
- Full-field multi-scale approaches and periodic homogenization based on either the FEM or the FFT.
- Comparisons between different multi-scale approaches
- RVE generation and evaluation techniques
- Introduction of complex deformation mechanisms like viscoelasticity and/or (visco)plasticity into multi-scale approaches.
- Introduction of complex degradation mechanisms like non-local damage or cohesive zone models into multi-scale approaches.

All these aspects are expected to be illustrated in the case of polymer composites such as long-fiber or short-fiber reinforced composites, woven composites, recycled composites, polymer blends and/or any other types of composites with thermoset or thermoplastic matrices.