Dynamic particle dynamics: a powerful tool for helping search solutions to improving the processability of ultra-high molecular weight polyethylene

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In this talk, we study experimentally and theoretically the effects of adding normal molecular weight polymers (NMWP) such as like PP, LDPE and HDPE as processing aids on the morphology and rheological behavior of ultra-high molecular weight polyethylene (UHMWPE). Scanning electron microscope (SEM) observations, rheological measurements and dissipative particle dynamics (DPD) simulations show that the formation of a lubricating phase in between the UHMWPE particles is responsible for the viscosity reduction of the UHMWPE. Phase diagram studies suggest that for a given UHMWPE/NMWP blend with fixed parameter χ and molar mass of each of the components, the optimum composition should be located in the composition sensitive region (CSR) of the blends for low shear rates. For high shear rates, the parameter χ should be above but close to the corresponding binodal curve. The methodology developed in this work could be extended to other types of ultra-high molecular weight polymers.