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Magnetic Field Driven Alignment of Cobalt Nanoparticles and Directional Strengthening Effect in Polystyrene Matrix Nanocomposites
HONGYI YUAN, The University of Akron, JEFFREY PYUN, The University of Arizona, ALAMGIR KARIM, The University of Akron, THE UNIVERSITY OF AKRON TEAM, THE UNIVERSITY OF ARIZONA TEAM — Nanocomposite thin films of Polystyrene (PS) and PS-coated cobalt (Co) nanoparticles were prepared by solution-mixing and flow-coating. Ferromagnetic Co nanoparticles were either randomly dispersed or aligned in 1-D by applying a weak magnetic field during the flow-coating process. AFM and TEM images show nano-chain formation by self-assembly of the Co nanoparticles in the concentration range of 2-10 wt% relative to PS in the presence of magnetic field. The technique of Strain-Induced Elastic Buckling Instability for Mechanical Measurements (SIEBIMM) was employed to determine the elastic moduli of neat PS and PS / Co nanocomposite thin films, which were calculated from the buckling patterns generated by applying and releasing tensile stresses. Strengthening effect was found in nanocomposite thin films depending on the alignment direction of the dispersed Co nanoparticles. The effect of shape and concentration of nanoparticles on the elastic modulus of nanocomposite thin films will be discussed.

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