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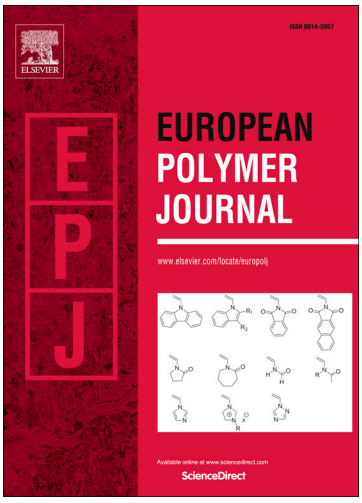

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Development of highly radiopaque flexible polymer composites for x-ray imaging applications and copolymer architecture-morphology-property correlations

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Abstract

X-ray opacity of polymer based medical implants is a desirable attribute for implant placement and function monitoring. This study presents the development of flexible thermoplastic composites with high radiopacity, low mechanical hysteresis, and excellent mechanical integrity *via* modulating vinyl acetate (VA) content in the melt compounded ethylene vinyl acetate copolymer (EVA) and barium sulfate (BS) composites. Extensive rheological, mechanical hysteresis, morphological, x-ray diffraction, mass attenuation and thermo-mechanical analysis were carried out to understand the interplay between the morphological distribution BS particles in the composites and the VA content. The results showed that 0.7 mm thick sheet of EVA/BS composites had markedly higher gray value (radiopacity) than 1 mm sheet of aluminum while retaining more than 1200% elongation at break and complete flexibility. Time-temperature (t-T) superimposition studies, fractional free volume, radiopacity, crystallinity, mechanical hysteresis, phase imaging, structural breakdown, storage modulus, loss factor and the complex viscosity of the melt showed high dependence on the vinyl acetate content of EVA and on the BS loading. These results will enable designing of flexible and thin radiopaque polymer composites for x-ray imaging applications, with predetermined physicomechanical and radiopacity behavior.

Keywords: Polymer composite; morphology-property correlation; Radiopaque; x-ray imaging; rheology