USE OF SBA-15 SILICA MATRICES TO STABILIZE AN IONIC LIQUIC/API FOR DRUG DELIVERY APPLICATIONS

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Aiming to stabilize an ionic liquid (1-ethanol-3- methylimidazole – C_2OHmim) intrinsically combined with an active pharmaceutical ingredient (Ibuprofenate – Ibu) in a metastable state where crystallization is avoided, the impregnation in mesoporous silica (SBA-15) was used as a strategy. The study was preceded by the investigation of the novel C_2OHmim/Ibu in bulk state, by both differential scanning calorimetry (DSC) and dielectric relaxation spectroscopy (DRS). The thermal characterization allowed characterizing C_2OHmim/Ibu as a glass former since it exhibits a glass transition; however, after some water removal it crystallizes.

Two silica matrices were synthesized with pore diameters of 4.5 and 5.6 nm. The successful impregnation of C_2OHmim/Ibu was confirmed by infra-red spectroscopy and by thermogravimetry (TGA) from which a loading of 53 and 58 % w/w was determined, respectively for the 4.5 and 4.6 nm matrices. Under impregnation on the silica matrix with 4.5 nm pore diameter, C_2OHmim/Ibu fails to crystallize and the material is preserved in the supercooled state at temperatures above -20ºC after water removal. A higher T_g was detected for compared with the bulk material that can be caused by guest interactions with the pore wall via H-bonds. This affects also the transport properties by the decrease in about 2-3 decades in both real conductivity and diffusion coefficient. For the guest impregnated in the 5.6 nm matrix, crystallization was detected, which is rationalized as 5.6 nm being a pore dimension that allows crystal growing. The successful avoidance of crystallization for 4.5 pore diameter with the material being stabilized in a more disordered state relative to crystal is very promising for controlled drug delivery applications.

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