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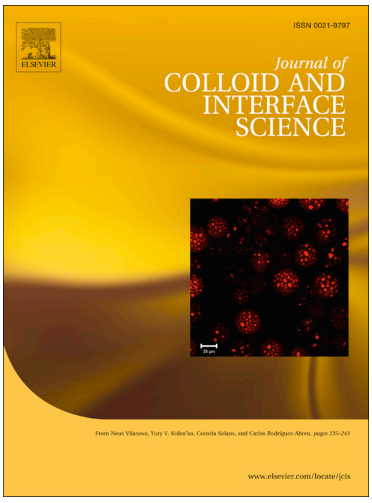

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Synthesis and Optimization of Polyurethane Microcapsules Containing [BMIm]PF_6 Ionic Liquid Lubricant

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Abstract：Polyurethane (PU) microcapsules containing [BMIm]PF_6 as a lubricant have been fabricated by interfacial polymerization. The stabilizing effect of 10 kinds of emulsifiers towards [BMIm]PF_6 ionic liquid have been delineated. A Pickering emulsion stabilized by lignin showed the best emulsification effect on highly viscous [BMIm]PF_6. The types and reactivities of monomers have an important influence on the formation of microcapsules. Three kinds of isocyanate (IPDI, MDI, TDI) were reacted with diamines or diols to prepare the PU microcapsules in this work. The optiaml [BMIm]PF_6@PU microcapsules were obtained when using IPDI and TETA as monomers, under conditions of 5,000 rpm emulsifying rate, 0.5 wt.% concentration of lignin Pickering emulsion, and a 3:1 mass ratio of [BMIm]PF_6/IPDI. The synthesized microcapsules have a regular and compact spherical structure, smooth outer, and inner surfaces with a mean diameter of 43±15 μm, and a thickness of 3.8 μm. The core content of [BMIm]PF_6@PU microcapsules was determined as >70%, and the initial decomposition temperature was 300℃. The [BMIm]PF_6 ionic liquid shown excellent lubricating property, ultralow friction coefficient (decreased by 72.7%) and wear rate (decreased by 160 times) were obtained by embedding 30 wt.% microcapsules into epoxy compared with pure epoxy.

Keywords: polyurethane microcapsules; [BMIm]PF_6 lubricant; Pickering emulsion; high core content; excellent thermal stability

1 Introduction

The synthesis of self-lubricating microcapsules is attracting extensive interest from researchers due to their wide application in self-lubricating polymer composites [1-4]. Many preparation techniques of self-lubricating microcapsules have been designed according to the different synthetic conditions of their wall materials, such as solvent