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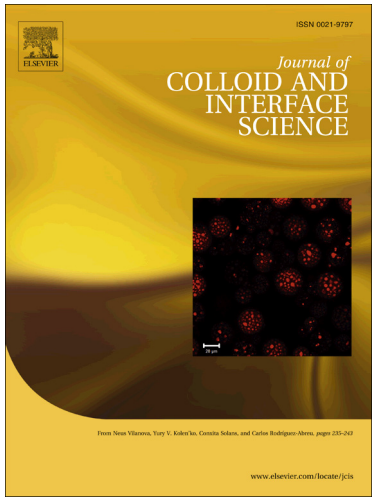

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An Evaluation of Complementary Approaches to Elucidate Fundamental Interfacial Phenomena Driving Adhesion of Energetic Materials

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Abstract

Cohesive Hamaker constants of solid materials are measured via optical and dielectric properties (*i.e.*, Lifshitz theory), inverse gas chromatography (IGC), and contact angle measurements. To date, however, a comparison across these measurement techniques for common energetic materials has not been reported. This has been due to the inability of the community to produce samples of energetic materials that are readily compatible with contact angle measurements. Here we overcome this limitation by using physical vapor deposition to produce thin films of five common energetic materials, and the contact angle measurement approach is applied to estimate the cohesive Hamaker constants and surface energy components of the materials. The cohesive Hamaker constants range from 85 zJ to 135 zJ across the different films. When these Hamaker constants are compared to prior work using Lifshitz theory and nonpolar probe IGC, the relative magnitudes can be ordered contact angle > Lifshitz > IGC. Furthermore, the dispersive surface energy components estimated here are in good agreement with those estimated by IGC. Due to these results, researchers and technologists will now have access to a comprehensive database of adhesion constants which describe the behavior of these energetic materials over a range of settings.

Keywords: Contact Angle; Interfacial Energy; Surface Energy; Wettability; Hamaker Constant; Energetic Materials

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