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Abstract Solvents have been used for self-healing materials for swelling mechanism. However, no study has investigated the prediction of solvent healing performance. In this work, we used Hansen solubility parameters (HSPs) to predict crack healing. A 2D solvent map was constructed by polarity and hydrogen bonding parameter. Results showed that the degree of swelling was relative to the HSP distance (D) between solvent and epoxy resin in the map. Moreover, manual healing experiments showed that solvent healing performance was correlated with swelling. Therefore, the healing performance of solvents could be predicted by using HSPs. For epoxy resin, solvents with D < 15 had excellent healing performance. This framework simultaneously considered D and water solubility and could be readily extended to fast screen green solvents for microcapsule-loaded self-healing materials.

Keywords: Biomimetic; Polymers; Self-healing; Hansen solubility parameters; Welding; Functional

1. Introduction

Inspired by biological system, the self-healing materials based on microcapsules has been developed [1−4]. The healing process is triggered by the rupture of the microcapsule when a crack propagates through the matrix. This process is followed by the release of a healing agent into the crack plane. The crack is then bonded by the reaction between the healing agent and catalyst without any external intervention. To date, the most useful healing chemistries include the ring-opening metathesis