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ARSST Experiments to Evaluate Solvent Compatibility with Stabilized Lithium Metal Powder (SLMP™)

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The ARSST (Advanced Reactive System Screening Tool) is a simple adiabatic calorimeter that is widely used to screen for energetic materials and to quickly develop data for safe process design. The instrument is well suited for long-term stability studies, to characterize runaway reactions, and to evaluate material compatibility.

Recently the ARSST has proved useful for characterizing material compatibility between Lithium compounds and various solvents or binders. This paper presents test data to illustrate the application using standard grade Stabilized Lithium Metal Powder (SLMP™) and various solvents (GBL, NMP, and Xylenes).

Summary

A series of ARSST experiments was performed using standard grade SLMP and various solvents, in some cases doped with DI water. Solvents used here were NMP (1-Methyl-2-pyrrolidone), GBL (γ-Butyrolactone), and Xylenes. Previous SLMP™/solvent stability studies have been reported by others (1).

The ARSST calorimeter typically uses a magnetically stirred 5 ml or 10 ml lightweight glass test cell of negligible thermal inertia and with direct temperature and pressure measurement. The test assembly is contained within a protective containment vessel for safety, but liquid can be externally added during a test. The ARSST and its application to reactive hazards evaluation has been described in detail elsewhere (2,3). Figures 1 and 2 illustrate the equipment set-up for closed cell testing, a relatively new configuration (4) which has proved useful in the present study.

Sample loading was generally performed under argon atmosphere using a glove bag. A typical test used 0.25 g SLMP™ and 9 ml of solvent. Tests were performed using both open and closed test cell configurations. In all but one test the nominal test cell volume was 10 ml (one test used a 20 ml cell). Some tests were performed using a long term isothermal hold technique, while in other tests the sample was heated up at a constant rate of 2°C/min (non-adiabatic). Finally, tests on doped GBL and NMP were performed in adiabatic scan mode at a background imposed rate of about 1°C/min, effectively a constant power mode (as opposed to non-adiabatic constant rate mode).

The samples were magnetically agitated using a Teflon coated stir bar of 1 cm length. Initial open cell tests used a conventional bench top stirrer set at a midrange value of "5". The closed cell tests used a stronger "Super Stirrer" with selectable RPM.