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Thermal Hazards Evaluation Using the ARSST

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ABSTRACT

Potential reactive chemical hazards are identified and quantified quickly and safely using the Advanced Reactive System Screening Tool (ARSST). This compact calorimeter has proven reliability for obtaining directly scalable rates of energy and gas release during a runaway chemical reaction as demonstrated over the last 15 years through consistently good performance in a variety of DIERS "round-robin" studies. More recently the ARSST has been used to investigate chemical compatibility, characterize foamy/nonfoamy behavior (reactive or non-reactive), evaluate isothermal stability, and estimate SADT values. This paper illustrates a number of applications where routine ARSST testing has provided an inexpensive and practical solution for evaluating thermal hazards.

1. INTRODUCTION

Safe process design requires knowledge of energy and gas release rates for systems under upset conditions and the potential for foamy behavior during the emergency discharge process. The Design Institute for Emergency Relief Systems (DIERS) program [1] provided the chemical process industry with analytical tools necessary to gather such data which cannot be predicted from first principles [2]. The Reactive System Screening Tool (RSST) later provided an easier, less expensive approach to the DIERS methods [3,4]. The ARSST, like its predecessor the RSST, has since become a standard laboratory instrument for rapidly screening and characterizing chemical systems in addition to providing directly scalable relief-system design data. Today the ARSST technology is a key component of minimum best practice at over 200 facilities throughout the world [5].

2. ARSST DESCRIPTION

A complete description of the ARSST and its design principles is available elsewhere [6,7,8]. This section provides a quick overview, but also describes some more recent developments.

The basic components of the ARSST (Figure 1) include a spherical glass test cell (10 ml standard), its surrounding "bottom heater" jacket and insulation, thermocouple(s) and pressure transducer, and a 350 ml (or 450 ml) stainless steel containment vessel that serves as both a pressure simulator and safety vessel. An immersion heater can also be