

Materials Study Supporting Thermochemical Hydrogen Cycle Sulfuric Acid Decomposer Design

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ABSTRACT

A laboratory scale sulfuric acid decomposer simulator was constructed at the Nuclear Science and Engineering Institute at the University of Missouri- Columbia. The simulator was capable of producing the temperatures and corrosive environments that process equipment would be exposed to for industrialization of the sulfur iodide or hybrid sulfur thermochemical cycles. A series of boron treated synthetic diamonds were tested in the simulator to determine corrosion resistances and suitability for use in thermochemical process equipment.

The study concluded that boron treated diamonds were not suitable for use in decomposer process equipment. Unacceptable corrosion rates were observed at 600°C and increased linearly with temperature up to 700°C. The boron treated diamonds completely disassociated at temperatures above 700°C. The researcher postulated that the high corrosion rates resulted from diamond carbon having a higher preference for oxygen free radicals formed during the decomposition process. Oxygen free radical concentration also increased as a function of increasing temperature.