

**MATERIALS ENGINEERING
SEMINAR**

“Fabrication and Analysis of Al₂O₃/Cr Cermets Made via the Reduction of Cr₂O₃ by Al”

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Purdue MSE Preliminary Exam

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ABSTRACT

Ceramic-metal composites, also known as cermets, have attractive properties owing to the combination of a ceramic's chemical and high temperature stability and a metal's toughness. One cermet system of interest is Al₂O₃/Cr, which possesses high oxidation resistance and a good thermal expansion (CTE) match between the components. The combination of these properties is attractive for Concentrated Solar Power (CSP) plants, namely for use as the primary heat exchanger in a high temperature oxidizing environment. This cermet has been fabricated using a number of methods, many of which take advantage of the displacement reaction between Cr₂O₃ and Al to form the Al₂O₃/Cr cermet. Two reduction methods detailed in literature are reactive hot pressing and combustion synthesis. Hot pressing is done by pressing the constituents together at temperature in a die under a constant load. Combustion synthesis utilizes the high exothermicity of the reaction to fully convert the reactants at temperatures lower than those used in reactive hot pressing. Besides these fabrication methods, brief study was performed on the corrosion of a thin Cr₂O₃ coating in a liquid Al bath, which may lead to a new approach in making the Al₂O₃/Cr cermet. To better utilize the existing fabrication methods involving the reduction of Cr₂O₃ by Al, a kinetic study of this reaction was done but the results are incomplete, and a future study is needed to fully understand the kinetics of reduction and the rate-limiting steps.

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Place: ARMS 1021**

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