High-Temperature Corrosion of Iron-Aluminide Hot-Gas Filters in a Coal Gasification Environment

P.F. Tortorelli, C.G. McKamey, I.G. Wright, B.A. Pint, and R.R. Judkins

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6156 USA

Because of their good to excellent high-temperature corrosion resistance in sulfur-bearing environments, iron-aluminide alloys are attractive for application as materials of construction for metallic filters to be used to clean fossil-fuel-derived gases prior to their introduction into gas turbines. Commercial hot-gas filters of a Fe_3Al-based aluminide, and sections cut from such, were exposed in gas cleaning systems of a coal gasification plant at temperatures around 500°C and then microstructurally analyzed to determine the nature and extent of any degradation as a function of environmental variables. The results showed that the principal mode of attack involved the formation of iron sulfide that grew into and occluded the pores. This process appeared to be related to the breakdown of any alumina layer as aluminum was depleted from the filter alloy matrix by corrosion reactions. However, preoxidation provided protection from such degradation for extended exposure times.

Research sponsored by the National Energy Technology Laboratory, Office of Fossil Energy, U. S. Department of Energy, under contract DE-AC05-00OR22725 with UT-Battelle, LLC.