

FLUX SYSTEM DESIGN AND OPTIMIZATION
OF SHIELDED METAL ARC WELDING
FOR HIGH NICKEL ALLOYS

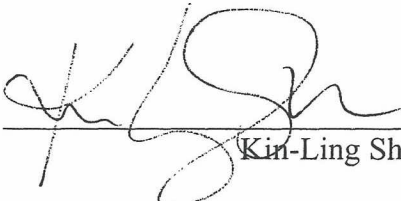
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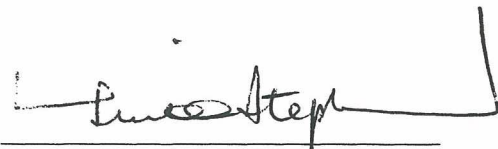
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A thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Master of Science (Metallurgical and Materials Engineering).

Golden, Colorado

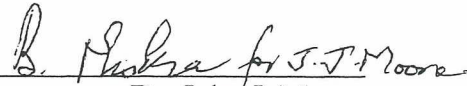
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ABSTRACT

The power generation industry is interested in producing an improved high nickel alloy shielded-metal arc welding (SMAW) electrode. To increase productivity in the welding of high nickel alloys, shielded metal arc (SMA) welding electrodes are to be developed to replace gas tungsten arc welding with cold wire feed. SMA welding electrodes were designed by developing proper flux coatings for extrusion and alloying.

The flux system design began with an equal distribution of cryolite, rutile, and calcium carbonate. The system was then optimized to enhance extrudability, slag viscosity, flux coating finish, fume formation, slag detachability, weld cleanliness, electrode weldability, weld penetration, wetting, arc stability, and weld composition. The appropriate amount of binder to add has been demonstrated to depend on the temperature and humidity of the working area. The particle size distribution of the dry mix should follow a normal distribution with a maximum frequency at 200 mesh.

Detailed mass balance type calculations were performed to determine alloying element transfer behavior across the arc and to understand weld metal recovery from the flux coating, filler metal wire and base metal. For chromium and manganese, an average of 95 and 75 percent weld recovery was determined, respectively. The recovery value of 70 percent was used for niobium recovery rate. This data is important for calculating the proper additions of these elements into the flux formulation.