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Improvements to Ingot Quality of Industrial-Scale Vacuum Arc Remelted Ti6Al4V by Application of Magnetic Sensing and Controls

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External transverse magnetic fields were applied during the vacuum arc remelting of 900 mm and 1000 mm Ti6Al4V ingots in order to control the arc dynamics. The overall goal of the industrial experiments were to provide a known arc distribution throughout the melt, including startup and hot topping, that optimizes solidification. Magnetic field sensors (VARmetric) were deployed to continuously monitor the arc position during the experiments, while electromagnets (ARControl) were utilized to control the location and distribution characteristics of the arc. The vertical position of the electromagnet system was automatically repositioned throughout the melt to move with the arc gap location, which was determined by magnetic arc gap tracking. Feedback from magnetic arc position sensing was also used in real time to ensure safety during the experiment through side arc detection. The result(s) of the application of transverse magnetic fields was to broaden the arc distribution, shallowing the melt pool and reduce uncontrolled variation in the arc location. An additional benefit was an improvement in the ingot skin quality. Overall results in the increase in yield and product quality are addressed.

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