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Consumable electrode vacuum arc remelting of gamma-TiAl with online feeding

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Vacuum arc remelting is widely recognized for its ability to produce high quality ingots for demanding applications. Since its introduction in the 1940s, great efforts have been undertaken to increase productivity, reliability and furnace safety by different iterations of furnace design accompanied by improvements in process data acquisition and interpretation to allow remelting behavior simulation. However, essential challenges regarding the heat extraction remain to this day, due to the direct coupling of melt rate, melt power, gap distance, furnace geometry, cooling capabilities and physical properties of the material when using a conventional vacuum arc remelting setup with consumable electrode. These parameters define achievable temperature gradients and heat transfer limits in the system, thus dictate the microstructure formation as well as segregation effects. To overcome these limitations, a novel approach is introduced at IME RWTH University, which uses a continuous online feeding of same sort metal powder into the melt pool during the remelting process, to increase heat extraction and nucleation density. In this study the successful introduction of metal powder into the pool via online feeding during vacuum arc remelting with consumable electrode is presented together with its influence on the process behavior and remelting result.

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