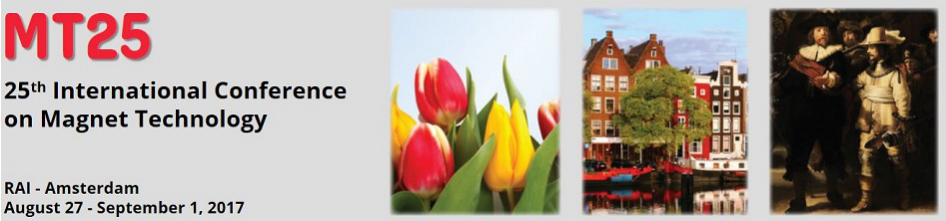

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A Superconducting Magnetic Density Separation Laboratory Demonstrator

Wednesday, 30 August 2017 13:15 (1h 45m)

An optimized NbTi-magnet lay-out has been designed for a Magnetic Density Separation (MDS) system. MDS is a novel recycling technology that allows the separation of non-magnetic materials based on their mass density. In the process, products are submerged in a ferro-fluid stream that flows over a magnet system which produces a strong vertical field gradient. The combined weight of the particles and magnetic force on the fluid results in different equilibrium heights for particles with different mass density. State-of-the-art MDS uses permanent magnets, limited in size and strength. This work replaces the permanent magnets with superconducting ones, enabling higher field strength and system size, resulting in a more dilute ferro-fluid and a deeper fluid bed. The main project goal is to demonstrate the benefits of superconducting MDS by building a NbTi-system integrated in a complete MDS set-up. Significant progress has been made towards the system design. To minimize fluctuations in particle trajectories, the magnetic field gradient ideally should only have a vertical component. This vertical gradient should be constant in the horizontal directions and in practice decays exponentially with the distance to the coils. Optimized coil configurations have been identified that minimize vertical magnetic field gradient variations. In a finite-length magnet system horizontal gradient components are unavoidable, which slow down particles. Thus a minimum flow speed is required to prevent clogging. Also, the particles need some time to reach their equilibrium heights. These contradictory requirements were investigated by numerical simulations of particle trajectories, leading to optimal system length and flow speed estimates. Construction of the magnet will start in the second half of 2017.
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