Materials Science & Engineering and Metallurgical Engineering Graduate Seminar

Wednesday, March 6 2019, 4:10-5:00PM, FASB 295

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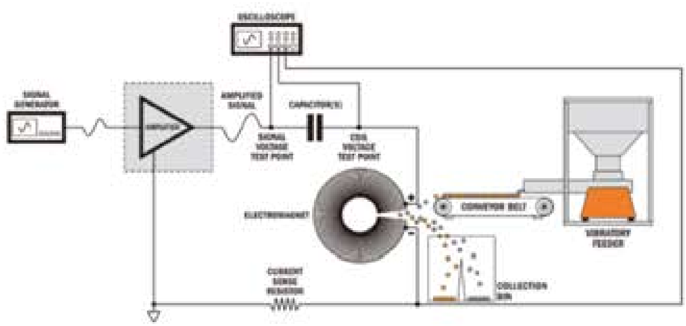
Electrodynamic Sorting of Light Metals

A novel technique for sorting nonferrous metal scrap using a solid-state eddy current device is presented. Current day eddy current devices use a drum fitted with permanent electromagnets around the drum. As the drum spins it generates a time varying magnetic field at a low frequency which induces eddy current in the metal particle. Instead, the solid-state device uses a ferrite core excited by an alternating current. The frequency of the field reaches upwards of 37 kHz. First, the theory of eddy current and the force generated in metallic particles is presented, followed by sorting results for different combinations of aluminum, copper and brass spheres. The sorting process is dependent on the electrical conductivity, density and geometry of the scrap metal particle. The net force acting on the particle due to the time-varying magnetic field is important to the design of large throughput sorters. The net force acting on spherical particles of copper, brass and aluminum is measured with a force probe. The agreement between Lohofer's expression for the force with experimentally measured force is shown. Next, the force acting on cylinders, cubes and disks is presented.
Finally, the development of the eddy current sorter prototype based on these principles is presented. The final prototype sorts automobile shredder residue at a rate of 500 pounds per hour. It upgrades a 70% aluminum scrap to 95% by weight in the clean product.



Raj K. Rajamani is professor with the department of metallurgical engineering department. His research activities span the following topics: mineral grinding kinetics and scale-up to plant scale mills, computer control of grinding circuits, computational fluid dynamics of cyclones, the simulation of charge motion in large grinding mills with the discrete element method, mineral grinding with high pressure grinding rolls, fine grinding with planetary mill and electrodynamic sorting of light metals and alloys.