

# Behaviors of magnetic particles during high gradient magnetic separation

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High gradient magnetic separation (HGMS) is the way to separate particles dispersed in a fluid depending on the difference of their magnetic susceptibilities using magnetic filters. Since particles are captured on the filter wire by the magnetic force acting on each particle, the filter openings can be made much larger than the particle size, which makes it possible high-speed separation with low pressure loss. In addition, when the magnetic field is removed, the deposited particles can be detached from the filter, making it possible to reuse the filter, which reduces costs and is also environmentally friendly. However, details of the particle deposition in the separation process are not well understood, therefore, the separation process is often performed under extreme conditions than necessary. If the particle deposition process on the magnetic wires and the behaviors of particles in a fluid are well understood, it may contribute to optimize the separation condition and is expected to lead the further applications of HGMS into wide range of fields. Therefore, in this study *in-situ* observations of particles deposition process during HGMS have been investigated.

Two CCD cameras were set parallel and perpendicular to the fluid flow, respectively, to observe the deposition process. In this study, two filters were set in the transparent filter housing. As a result, magnetic particles introduced into the filter housing formed chain-like structures or the bundles of such chain structures before reaching the magnetic filters due to their magnetization caused by the externally applied magnetic fields. Thus formed chains and bundles were captured at the first filter and, as a result, spike-like structures formed on the upper stream side of the first filter. At the second filter, particles deposited uniformly on the filter wires. Many particles are also held in the space between two filters. In fact, as particle deposition progresses, the top surface of the deposition moves upward as time passes, and accumulation of particles at the tip of already deposited structure were observed.

In this presentation, details of the experimental observations will be reported.