Development of a Novel Metalworking Fluid Engineered for Use with Microfiltration Recycling

Microfiltration can increase the service life of metalworking fluid by removing contaminants. However, membranes quickly become clogged, a process known as fouling. Anti-fouling methods in practice in the mid-2000s involved backpulsing the membrane or modifying its surface to mechanically remove fouling. However, those methods merely slowed fouling and did not prevent it. Thus ISTC's Kishore Rajagopalan and colleagues from the University of Illinois set out to develop a new metalworking fluid that does not foul the membrane.

ITo develop the novel fluid, the research team needed to understand what mechanisms were causing the α-alumina microfiltration membranes to foul. Typically membranes foul because of three mechanisms:

- the pore size is reduced due to fluid component adsorption,
- destabilization causes microemulsion aggregates to block pores, and
- microemulsions are deposited on the membrane surface and constrict pore size.

Researchers designed a semi-synthetic metalworking fluid that is strongly electronegative and has a compact emulsion to prevent degradation and microemulsion formation. Flow tests showed no reduction in flux, meaning that none of the chemicals adsorbed to the membrane to reduce pore size. The newly developed fluid also compared equally to commercially available semi-synthetic metalworking fluids for both cooling and lubricity in drilling and tapping torque machines.

Meet the Scientists

Kishore Rajagopalan

Publications

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