Electron backscatter diffraction yields microstructure insights
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"When you have deformations from machining, it is a great help to make the deformations visible," author and professor of physics of magnetic materials at Aalen University Dagmar Goll said. "In order to get deeper insight into the material's structure, electron backscatter diffraction is really useful. For example, grain size and shape, texture and degree of elastic strains and plastic deformations can be determined."

The authors compared the effects of various machining types on the microstructure of electrical steel. During machining, the cutting edge of the material is damaged, changing the crystallographic structure. "We evaluated the misorientations of grains in the material. So in the case of the cutting edge, we evaluated inhomogeneous areas with plastic deformations." Goll said. While these characteristics are microscopic, the cumulative effect in the material's structure adds up to a loss of efficiency in the final product.

"In the case of the powder metallurgical soft magnetic composites, which allow a higher degree of freedom in the design and construction of electric motors, we evaluated the recrystallization process during manufacturing as a function of compaction pressure, annealing parameters and powder particle size," author David Schuller said.

"We are improving the ratio between particle size and grain size distribution of the material," he said. "Depending on the annealing temperature, we can control grain growth and recrystallization in order to tailor the magnetic properties and minimize the magnetic losses."

The methodology developed by Schuller and colleagues provides a new tool to see exactly how, where and to what extent the crystalline structure is disrupted in machining processes and can be recovered during annealing. Their results show that EBSD is a powerful and versatile characterization technique for investigating and tailoring soft
magnetic materials.


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