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Laser-Based Sample Preparation for Microstructure Diagnostics

There is an increased demand for preparation techniques tuned to manifold methods of microstructure diagnostics that need to be fast, reliable, cost effective, artifact-free, and targeted. Traditional mechanical preparation and focused-ion-beam micromachining currently dominate the field. Laser-based sample preparation represents a very valuable alternative approach and make new sample geometries possible. This whitepaper shows the advantages of this technology and how it can be used to prepare TEM lamellas.

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3D-MICROMAC

Laser-Based Sample Preparation for Microstructure Diagnostics

Laser micromachining opens up new vistas for targeted and high-throughput methods of microstructure diagnostics.

Microstructure diagnostics and failure analyses are pivotal for the ongoing improvement of functional materials and sophisticated electronic components. Although lasers are well established tools and probes in manifold applications, they have been broadly ignored for use in sample preparation due to concerns regarding their potential for causing structural damage. Today, however, the use of ultrashort pulsed and optimized processing routes is addressing these concerns and enabling laser processing to finally enter the scene - speeding up microstructure diagnostics and failure analysis as well as opening up access to deeply buried structures and large-area preparation.

Tradeoffs of traditional sample preparation methods

There is an increased demand for preparation techniques tuned to manifold methods of microstructure diagnostics that need to be fast, reliable, cost effective, artifact-free and targeted. Traditional mechanical preparation and focused-ion-beam micromachining currently dominate the field. While the former is accompanied by high costs for skilled personnel, the latter is characterized by very high cost of ownership.

Laser-based preparation represents a very valuable alternative approach as shown below.

Process flow for in-plane geometries and bulk samples

Based on patented processing, 3D-Micromac's microPREP high-throughput sample preparation solution provides laser cutting of a base structure followed by local laser thinning in an almost entirely automated fashion. Making use of a rugged pulsed laser source, the process is characterized by very low running costs, suitability for semiconductors, metals, ceramics and compounds, and a very high targeted precision on the micron scale.

Unequaled flexibility helps fulfill manifold demands

Using finely focused lasers as a tool for micromachining provides a wealth of flexibility. One can design and cut a base structure to exactly fit the needs for successive characterization of the microstructure (such as tips, bars, etc.). The second step of the laser-based preparation, the thinning of the base structure, offers an unequalled choice of patterns.

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