Broad Ion Beam milling

– specimen preparation of any material from soft fibres to hard ceramic materials

In microscopy and microanalysis, we study how chemical composition and microstructure affect different materials' final properties and how these can be improved. At RISE we have the latest technology when it comes to scanning electron microscopy (SEM).

To make sure that the analyses give correct results, it is of paramount importance that specimen handling and preparation is performed in a proper way. We work regularly with all kind of materials, from soft fibres to hard ceramic materials. We have many years of experience in choosing and performing the suitable specimen preparation method for each specific material/specimen, depending on what will be evaluated.

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Challenging specimens

Specimens containing soluble/volatile substances, consisting of combinations of materials (a mixture of hard and/or brittle materials and soft materials), or heat sensitive materials such as low melting polymers or cellulose are especially challenging. For these materials, Broad Ion Beam (BIB) milling most often gives the best specimen preparation result.

The surface is polished using ion beams (argon ions), that in a very gentle way remove atom layer after atom layer without deforming the material. In this way, for example a cross section of a lacquered sheet metal can be produced without damaging the lacquer paint and any applied pre-treatment layer between lacquer paint and sheet (see figure 1).

Good results for difficult specimens

Soft materials like polymers and cellulose are deformed when cut and/or grinded/polished mechanically. Specimen preparation by broad ion beam milling clearly gives the best result in this case, when producing a specimen cross section (see figure 2). If the material is heat sensitive, the specimen may be cooled with liquid nitrogen to avoid heating during ion milling.

Extremely hard materials cannot be deformed easily but are often very brittle and thus break during mechanical cutting/grinding.

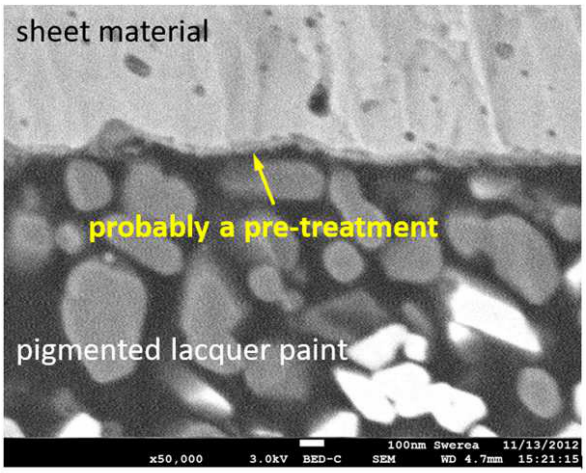

Figure 1. SEM image of lacquered sheet material. Between the metal sheet and the pigmented lacquer paint, a very thin layer (approximately 30-50 nm) is observed, probably a pre-treatment layer (x50 000).

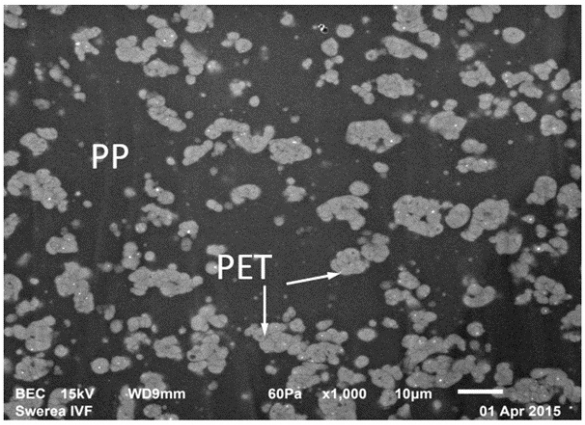

Figure 2. SEM image of polyester (PET) embedded in a polypropylene (PP) matrix (x1 000).