Challenges and perspectives of inverse production for sustainable material recycling – what LIBS can contribute

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The advance of automated production has triggered tremendous productivity gains in developed countries worldwide. Well-defined raw materials and primary products are used to produce complex semi-finished products and, ultimately, end products, through the massive use of automated processing and production processes. These often contain a wealth of valuable raw materials to ensure the desired properties and functions. The number of elements of the periodic table, which thus find their way into the final product, tends to increase. This applies in particular to high-tech products such as electronics of computers and mobile phones, but also to automobiles and tools for machining. At the end of the product lifetime, many recyclables occur still as material mixtures. Conventional recycling methods provide only a very limited content-related sorting in order to obtain high-quality material fractions. In most cases, a preconditioned mass flow is processed metallurgically in order to recover some of the valuable metals.

But which chances are opened up if these products are disassembled at the end of their use with modern methods of production technology and are sorted based on inline gained chemical information, in order to win high-quality fractions? From these the valuable materials contained can be obtained in a more efficient way than now. What are the challenges of this so-called *inverse* production? Approaches to this are presented and exemplified by recent developments for the disassembly of electronic boards, with which hitherto inaccessible sorting fractions with high value enrichment can be obtained.

Laser-induced breakdown spectroscopy and laser processing technology play a key role for the sketched measurement tasks. Recent developments of scanning LIBS systems will be presented which serve to identify valuable materials in electronic components and tool steels.