4D-STEM-in-SEM: New trend in electron microscopy

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Electron microscopy (EM) techniques are among the most common methods for characterizing newly developed, existing, recycled, and/or recyclable materials. In our laboratory, we apply EM methods mainly to systems involving synthetic and natural polymers, their blends and composites.

In the first part of this contribution, we will give an overview of the basic methods of both scanning electron microscopy (SEM) and transmission electron microscopy (TEM). We will explain how and why EM methods can be advantageously combined with measurements of local mechanical properties using microindentation (MHI) and nanoindentation (NHI) instrumentation. We will show several cases from polymer research where we have taken advantage of the combined study of microstructure (by EM) and micromechanical properties (by MHI).

In the second part, we will mention the latest trends in the field of electron microscopy. In particular, we will note the 4D-STEM-in-SEM (four-dimensional scanning transmission electron microscopy in SEM) method and its variant 4D-STEM/PNBD (powder nanobeam diffraction). The method allows, among others, to use modern electron microscopes as simple, fast, and user-friendly powder electron diffractometers. Again, we will give examples from practice, namely the study of nanocrystalline fillers in so-called functional polymer materials.

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