Methods for investigating austenite stability during tribological stressing of FeCrNi alloys

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One basic field for efficient and environmentally compatible future power supply is hydrogen technology. This comparatively new technology with storage of cold liquid hydrogen makes high requirements on technical safety.
Austenitic stainless FeCrNi alloys are traditional materials in use for cryotechnology. They are also important for applications in superconductivity because austenite is a non-ferromagnetic phase. Mechanical and magnetic behaviour of the material depends on the stability of the microstructure.
However, unwanted formation of martensite leads to embrittlement and to a change of magnetic properties. In the frictional systems of cryotechnology, several transformation favouring factors may act at once: low temperatures, plastic deformation, and influence of hydrogen.
For evaluating the deformation induced amount of martensite, there are several methods in use, such as optical microscopy, TEM, magnetic induction method, and X-ray diffractometry. It is sometimes possible to detect even small martensite volume fractions, giving information about the beginning stage of austenite-martensite transformation.
All those methods are not suitable for in-situ experiments. This provides a good field of application for acoustic emission. The monitoring of acoustic emission during tribological stressing allows detecting the formation of martensite during the friction process because phase transformations lead to sudden release of energy. However, acoustic signals are released by plastic deformation as well. Therefore, they need to be separated in a useful way.
Starting from known results of other temperature or deformation induced phase transformations, preparing experiments and first own measurements are presented. An outlook is given to future applications of acoustic emission testing in tribology and cryoengineering.