

**TRACE ELEMENT ANALYSIS OF NB AND RARE EARTH ELEMENTS IN
METAL ALLOYS:
COMPARISON OF SR-TXRF WITH SR-XRF ON THIN FILMS (API™).**

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Total Reflection X-Ray Fluorescence (TXRF) is a powerful trace and ultra trace analysis technique. Due to the effect of total reflection a minimal part of the exciting beam is transmitted into the sample support, thus the background is mainly given by the sample itself. The comparison on the market of relatively low cost thin films (150nm), opens for standard 45°-45° EDXRF new frontiers and the possibility to compete with TXRF when extremely low detection limits are requested. Synchrotron Radiation is the ideal x-ray source for fluorescence analysis due to the natural collimation, the high flux and wide spectral range; the linear polarisation in particular leads to a significant reduction in the background due to scattering if the proper excitation-geometry is adopted, and it is therefore of importance especially for samples with a high content of rest matrix.

In the present work metal alloys for the contraction of nuclear reactor core elements are analysed. The Nb concentration in reactor pressure vessel steel allows a retrospective fast neutron flux determination, important to make predictions on the status and lifetime of the vessel. An international consortium (EURATOM USA JAPAN) pursues the development of Low Activation Material (LAM) alloys for the construction of future fusion power plants. The goal is the production of materials which 300 years after irradiation may be considered as non radioactive. Traces of Nb, Pd, Ag, Eu, Gd, Tb, Dy, Ho, Er, Os, Bi cause a higher activity of the material than the main components of the alloy. Synchrotron radiation permits the excitation of the heavier elements K-shells avoiding the strong overlaps of their L-lines.

The samples analysed were a Japanese steel and a Ti alloy candidate as LAMs. The preparation included dissolution in an acid mixture and ion exchange chromatography for the separation of the main components of the alloys.

Experiments have been performed at HASYLAB, Hamburg, Germany. The TXRF measurements were carried out using an apparatus developed at the Atominstytut and mounted for the beamtime at Beamline L, a bending magnet. The experiments with the API™ films were done with the microfluorescence facility permanently mounted at Beamline L.

A comparison of detection limits is presented.