Radioisotope Rh-101 as X-Ray Source for Instruments on Space Missions

Ch. Stenzel, Astrium GmbH, Friedrichshafen, Germany; Ch. Schroer, Technical Univ. of Dresden; B. Lengeler, RWTH Aachen; R. Vianden, Univ. of Bonn, Germany

For exploration missions to Mars or the Saturnian's moons the employment of X-ray instruments (XRD and XRF) is envisaged. Due to the harsh mass and volume restrictions only radioisotopes are suited as X-ray sources for instruments traveling on spaceships for several years. Isotopes, which have been applied so far, are not optimal for these missions in terms of half-life and X-ray energy (Fe-55) or specific activity (radioactivity/mass for Am-241).

Rh-101 represents an optimum choice concerning half-life (3.3 a) and X-ray energy (18 keV) for diffraction and fluorescence experiments of crushed samples from the planet's surface. Powder diffractometry with the much higher energy compared to Fe-55 would result in a reduced radiation background. Also a much broader excitation range for XRF is possible.

A source with an activity of several 100 MBq can be produced via a nuclear reaction in a cyclotron using light ions at a moderate consumption of beam time and by applying conventional techniques for separating and enriching the radioactive isotopes from the original Ru-target. This would yield a photon flux of about 10^6 photon/s in the detection angle.

First experimental results on the available production rates, additional gamma ray radiation, and the performance in a standard XRD/XRF laboratory set-up will be presented.