

# **DESIGN, DEVELOPMENT AND TESTING OF A TRANSPORTABLE BACKSCATTERING MÖSSBAUER SPECTROMETER FOR CERAMIC SURFACE ANALYSES**

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Ceramic materials have widely been studied by Mössbauer spectroscopy in order to obtain chemical and physical information, mainly regarding its oxidation state. The main limit of this technique is that a powder sample, for which a spectrum can be obtained in a transmission geometry, is always required defining Mössbauer spectroscopy as a destructive and invasive technique and usable only in a specialised laboratory. The only way to get a spectrum without sampling is to change geometry and to measure the radiation reflected by the sample. In this way a surface analysis is possible, obtaining chemical and information only of the outer layers of the artefacts, i.e., oxidation number, identification of the Fe bearing minerals. To do so, a reflection geometry may be used, but also in this case a small and thin object must be used, making this technique non destructive but still invasive. To overpass this problem a transportable Mössbauer instrument able to work in backscattering geometry has been projected and realized at the Mössbauer laboratory of the University of Padova.

It is based on the scheme of traditional transmission spectrometer with the main difference due to the fact that the  $\gamma$ -rays scattered by the iron atoms are collected by an array of four proportional counters placed around the sample on the same side of the radioactive source. As a consequence, four spectra are simultaneously recorded that are finally added to increase the signal to noise ratio. An appropriate software enable the spectrum analysis before the fitting procedure, allowing a better control of the resolution by choosing the best spectra addition. In this way spectra are easily obtained in a reasonable time without even touching the material. To control the quality and the reliability of the instrument, spectra of iron metal, pure hematite and other Fe(III) bearing minerals have been collected. To test the apparatus on ceramics artefacts several experiment on original specimen were performed inside the laboratory.