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Micro-IL and micro-PIXE studies of rich diamond meteorites at Legnaro nuclear microprobe

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Abstract

A combination of micro-ionoluminescence (micro-IL) and micro-PIXE was used to characterize diamond grains inside a type of meteorites known as ureilites. Ureilites are a group of achondrites unique in containing relatively large amounts of carbon occurring as diamond, graphite or lonsdaleite. A shock origin for ureilitic diamonds has been widely accepted though an exact knowledge of the conditions during high-pressure graphite conversion is not yet achieved.

Micro-IL is a very powerful technique for material investigation and particularly for diamond analysis. Using this technique we were able to identify the occurrence of the diamond phase inside carbon meteoritic inclusions and to perform micro-PIXE analysis on single diamond grains. In fact, IL in low nitrogen content diamonds is dominated by A-band emission (centered at about 2.9 eV) and so, considering only IL monochromatic map at such a spectral band, it was possible to identify them. By making measurements directly on the meteorites, contamination during chemical extraction processes was avoided and it was possible to study not only the diamond phase, but also its distribution inside carbon inclusions.

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1. Introduction

As known, ionoluminescence (IL or IBIL) technique is an advantageous tool in some material

science fields. Indeed, using conventional IBA techniques like PIXE, RBS or NRA it is only possible to measure elements amount without any information about chemical state. Instead IL can be used to obtain information about the nature of chemical bonds as well as defects and impurities presence and distribution down to ppm [1–5].

IL has some advantages with respect to the widely used cathodoluminescence; one of them is the relative absence of surface effects due to a

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