On the reliable structural characterization of polished carbons in meteorites by Raman microspectroscopy

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Whatever its anthropogenic or natural origin (terrestrial and extra-terrestrial), the carbon multiscale organization (structure, nanostructure) is a fingerprint allowing to reconstruct their formation and to better constraint the parameters such as precursor nature, temperature, pressure .... Raman microspectroscopy becomes nowadays a method of choice to characterize the carbon matter and is sensitive to the full range of the structural states present in this class of materials, from perfectly crystalline to amorphous. In the case of graphitic natural carbons materials, the intensity ratio I_D/I_G has frequently been used as a reliable quantitative parameter of the structural order such as the determination of the mean 'crystallites' diameter **[1]**. As far as the meteorites are concerned, the information can be obtained on the precursor origin, the metamorphism degree **[2-3]**...

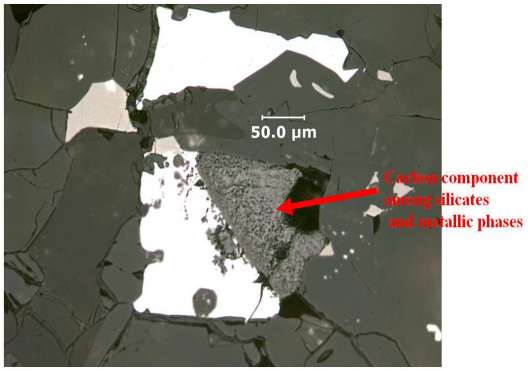

Fig.1: Optical microscopy observation of Acapulco meteorite

In order to characterize various carbons in meteorites and also to discriminate them from opaque components such as metallic phases, the optical observation has to be performed by the reflexion mode on carefully polished sections prior to performing the Raman analysis (Fig. 1). However, the reliability of such I_D/I_G ratio fails when the carbons were polished (Fig.2). This mode of preparation is known to be responsible for a remarkable growth of the D band intensity **[4-5]** and consequently induces prohibitory errors in the structural characterization and the estimation of the intrinsic and original degree of ordering in the meteorite cabons.

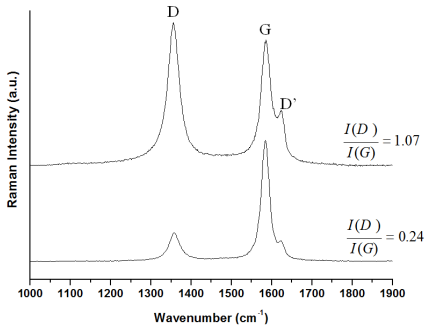

Fig.2: Raman spectra of polished (spectrum on the top) and unpolished (spectrum on the bottom) graphitized carbon obtained after 2900°C heat treatment.

In this presentation, the applicability of Raman microspectroscopy on polished graphitized carbons will be discussed in details. A new and reliable manner to obtain the intrinsic structural order from Raman spectra will be then given. An example of such application will be shown on the graphitized carbons found in the Acapulco primitive achondrite.

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