CATHODOLUMINESCENCE CHARACTERIZATION OF NANODIAMONDS: AN APPLICATION TO THE METEORITIC NANODIAMONDS. A. Gucsik[1], H. Nishido[2] and T. Nakazato[2], K. Ninagawa[3], [1]Max Planck Institute for Chemistry, P. O. Box 3060, D-55020 Mainz, Germany, (E-mail: gucsik@mpch-mainz.mpg.de); [2]Research Institute of Natural Sciences, Okayama University of Science, 1-1 Ridai-cho, Okayama 700-0005, Japan; [3]Department of Applied Physics, Okayama University of Science, 1-1 Ridai-cho, Okayama 700-0005, Japan.

Introduction: Primitive meteorites contain abundant (up to 1500 ppm) amounts of nanodiamonds. At least some subpopulation must be of pre-solar (stardust?) origin, as indicated by the isotopic composition of trace elements the diamonds carry, in particular noble gases [1] and tellurium [2]. On the other hand, the isotopic composition of the major element, carbon, is unremarkable, i.e. within the range reasonably expected for Solar System materials [3]. Two main theories exist for the formation process of the meteoritic nanodiamonds (e.g.,[4]-and references therein): (1) Chemical vapor deposition (CVD), and (2) shock origin. TEM investigations, in particular, seem to suggest that formation by a CVD process is most likely [4].

Samples and Analytical Procedures: K2 (Ultradispersed Detonation Diamonds-UDD) nanodiamonds were mounted in the non-radiative epoxy material. Their size dimensions were grouped into the following groups: less than 3nm (Diamond: A/1 and A/2), between 3-7 nm (Diamond: B/1 and B/2), bigger than 7 nm (Diamond: C/1 and C/2), and a mixture (Diamond: D/1 and D/2) all of them. CL measurements were obtained on carbon-coated, polished (by silicon colloids) thin sections. Color CL imaging was performed on a CL microscope. The system was commonly operated at 15 kV accelerating voltage and a beam current of 0.5 mA. CL colour images were captured using a digital photomicrographic camera system. High-resolution CL images and spectra were acquired using a scanning electron microscope (SEM at Okayama University of Science, Okayama, Japan) equipped with an grating-type monochromator, SEM-CL system. This system was operated at 15 kV accelerating voltage and a probe current of 1.5 nA. CL spectra were recorded in the wavelength range of 350-800 nm with 1 nm spectral resolution and a dwell time of 1 second per step by photon counting.

Results and Discussion: Cathodoluminescence spectral features of all K2 samples show two broad bands centered at around 388 (3.1 eV; A-center) and 452 (2.69 eV; N-center) nm (Figs. 1 and 2). According to Pratesi [5] in an agglomerated state: such agglomerates are called "A Centers" when occur as pairs of nitrogen atoms (type IaA), "B centers" when occur as four nitrogen atoms surrounding a common vacancy (type IaB) and mixtures of them may also occur. Type Ib – mostly represented in synthetic diamonds but very rare (about 0.1%) among natural diamonds – contain nitrogen as isolated single nitrogen atoms called "C Centers". Sometimes type I diamonds may also contain clusters of three nitrogen atoms called "N3 Centers".

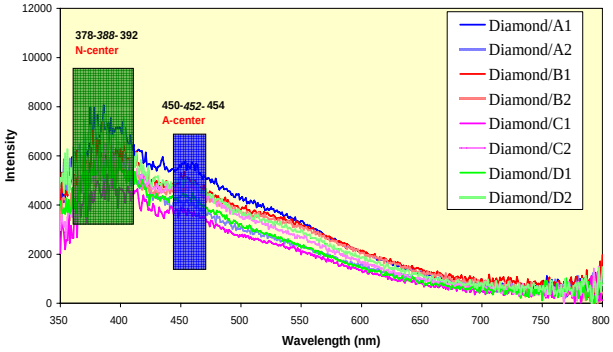

Figure 1. *Cathodoluminescence spectra of K2 nandiamond samples: Intensity vs wavelength.*

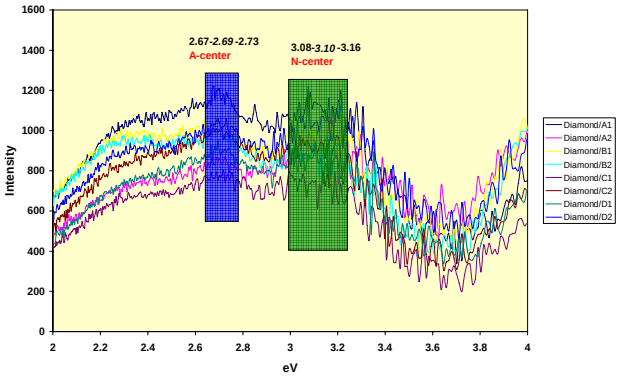

Figure 2. *Cathodoluminescence spectra of K2 nandiamond samples: Intensity vs eV.*

Consequently, the examples of exotic applications (astrochemical) of UDD as analog of interstellar grains in laboratory simulation experiments would be demonstrated by the cathodoluminescene techniques. Further comparative studies will be done using meteoritic nanodiamonds samples (e.g., yielded from Allende meteorite).

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