Noble Gases in Detonation and Meteoritic Nanodiamonds: a Comparative Study

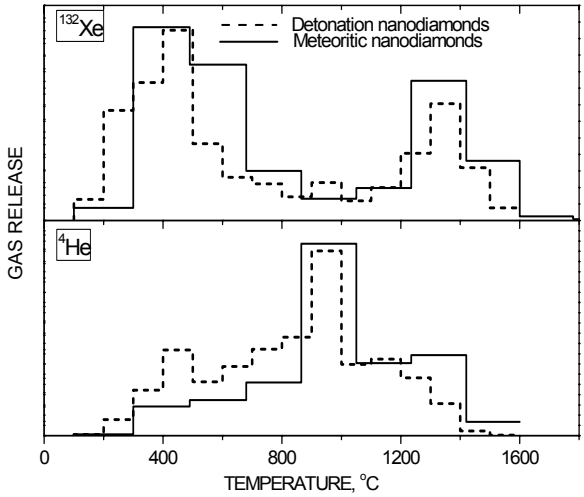
Koscheev A.P.[1], Ott U.[2], Huss G.R.[3]

[1]*Karpov Institute of Physical Chemistry, ul. Vorontsovo Pole 10, Moscow, 105064, Russia*
[2]*Max-Planck-Institut für Chemie, Becherweg 27, D-55128 Mainz, Germany*
[3]*University of Hawaii at Manoa, 1680 East-West Road, Honolulu, HI, 96822, USA*

Nanodiamond particles extracted from detonation carbon soot and from primitive meteorites have closely related properties (sizes, surface chemistry etc.). Meteoritic nanodiamonds (MND) contain isotopically distinct noble gas components and are considered as the "messengers from the stars" carrying the traces of nuclear and chemical processes in circumstellar media.

This is a review of our mass spectrometry studies of noble gases artificially implanted into ultradispersed detonation diamonds (UDD) and of extraterrestrial noble gases in MND. All studies were done using either stepped pyrolysis (up to 1600°C) or linear heating techniques allowing measuring the temperature profiles and the isotope composition of released noble gases.

Release profiles of noble gases from UDD and MND had striking similarity (see Figure) indicating that ion implantation is the most plausible mechanism of noble gas trapping by nanodiamond grains in interstellar space.



The data on MND, extracted from different meteorites, and on UDD of various types are presented. The studies of ion implantation at various conditions (ion energy and dose) allowed clarifying the mechanisms of ion trapping and thermal release of noble gases. Implications of these results to the interpretation of analytical data on noble gases in presolar nanodiamond grains are discussed.

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