Nanoscale physics

Conversion of electron beam energy into vacuum ultraviolet radiation of mixed argon–xenon nanoclusters

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Liquid rare gases of argon and xenon are often used as scintillators in dark matter detectors and various elementary particle studies, including neutrino astrophysics [1]. Scintillation emission spectra of these gases are dominated by the so-called second excimer continua centered at 127 nm for argon and 174 nm for xenon. Earlier, we studied the influence of small Xe admixtures in Ar nanoclusters and found an efficient channel of energy transfer from the argon matrix to the xenon admixture in mixed Ar-Xe clusters [2].

In this work, we estimate the efficiency of electron beam energy conversion into integrated intensity of the excimer continua of Ar and Ar-Xe nanoclusters with an average size of 400 atoms per cluster. To do this we measured with a calibrated AXUV-100 photodiode the absolute integrated intensity of argon nanocluster supersonic jet radiation in the vacuum ultraviolet and ultrasoft X-ray spectral ranges. Integrated intensities of the excimer continua were measured in the wavelength range of 119-147 nm for Ar nanoclusters and 167-200 nm for Ar-Xe nanoclusters. In the case of mixed Ar-Xe nanoclusters, the concentration of xenon in the primary gas mixture was $C = 1\%$, when their cathodoluminescence spectra displayed no excimer continuum from argon.

The obtained results demonstrate the possibility of using rare-gas cluster beams to simulate processes which occur in liquid rare-gas detectors.

1. *Curioni A.*. Noble liquid detectors for fundamental physics and applications // Nucl. Phys. B -Proc. Suppl..-2009.-**197**.-N 1.-P. 48-51.
2. *Doronin Yu.S., Samovarov V.N.*, **Spectroscopy of Mixed Ar–Xe Clusters: Formation of a Xenon Core //** Optics and Spectroscopy.-2007.-**102**, N 6.-P. 906-909.