# Radiation-induced transformations of isolated $CH_3CN$ molecules in noble gas matrices

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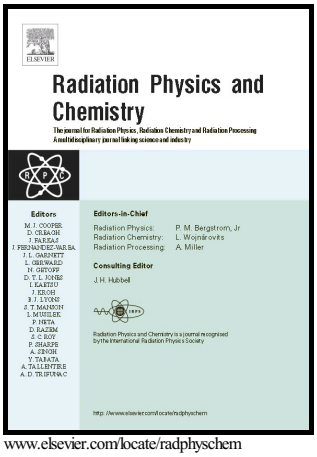


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# Radiation-induced transformations of isolated $CH_3CN$ molecules in noble gas matrices

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**Abstract**

The transformations of isolated $CH_3CN$ molecules in various solid noble-gas matrices (Ne, Ar, Kr, and Xe) under the action of X-ray irradiation at 5 K were investigated by FTIR spectroscopy. The main products are $CH_3NC$, $CH_2CNH$ and $CH_2NCH$ molecular isomers as well as $CH_2CN$ and $CH_2NC$ radicals. The matrix has a strong effect on the distribution of reaction channels. In particular, the highest relative yield of keteneimine ($CH_2CNH$) was found in Ne matrix, whereas the formation of $CH_3NC$ predominates in xenon. It was explained by differences in the matrix ionization energy (IE) resulting in different distributions of hot ionic reactions. The reactions of neutral excited states are mainly involved in Xe matrix with low IE, while the isomerization of the primary acetonitrile positive ions may be quite effective in Ne and Ar. Annealing of the irradiated samples results in mobilization of trapped hydrogen atoms followed by their reactions with radicals to yield parent molecule and its isomers. The scheme of the radiation-induced processes and its implications for the acetonitrile chemistry in cosmic ices are discussed.

**Keywords:** matrix isolation; acetonitrile; X-ray irradiation; FTIR spectroscopy



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