

PAPER • OPEN ACCESS

## Effects on nitrogen-acetone ice induced by energetic heavy ion collisions

To cite this article: K F Alcantara *et al* 2015 *J. Phys.: Conf. Ser.* **635** 022067

View the [article online](#) for updates and enhancements.

You may also like

- [Radiolysis of Ices by Cosmic-Rays: CH<sub>4</sub> and H<sub>2</sub>O Ices Mixtures Irradiated by 40 MeV <sup>58</sup>Ni<sup>11+</sup> Ions](#)  
C. Mejía, A. L. F. de Barros, H. Rothard et al.
- [A novel medium entropy alloy based on iron-manganese-aluminum-nickel: influence of boron addition on phase formation, microstructure, and mechanical properties](#)  
Gasan Hakan and Zamani Mohsen
- [Theoretical study of the hyperfine interaction constants, Landé g-factors, and electric quadrupole moments for the low-lying states of the <sup>61</sup>Ni<sup>9+</sup> \(q = 11, 12, 14, and 15\) ions](#)  
Ting-Xian Zhang, , Yong-Hui Zhang et al.



## ECS Membership = Connection

**ECS membership connects you to the electrochemical community:**

- Facilitate your research and discovery through ECS meetings which convene scientists from around the world;
- Access professional support through your lifetime career;
- Open up mentorship opportunities across the stages of your career;
- Build relationships that nurture partnership, teamwork—and success!

**Join ECS!**

**Visit [electrochem.org/join](http://electrochem.org/join)**



## Effects on nitrogen-acetone ice induced by energetic heavy ion collisions

K. F. Alcantara<sup>\*1</sup>, A. L. F. de Barros<sup>†</sup>, E. F. da Silveira<sup>\*</sup>, H. Rothard<sup>□</sup>, P. Boduch<sup>□</sup>

<sup>\*</sup> Departamento de Física, PUC- Rio, Rua Marquês de São Vicente 225, 22451-900, RJ, Brazil.

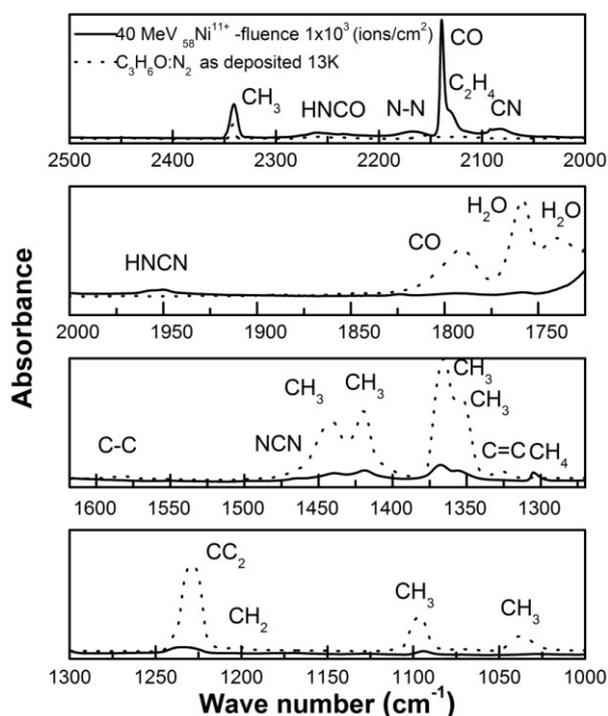
<sup>†</sup> Departamento de Física, CEFET-RJ, Av. Maracanã, 229, 20271-110 Rio de Janeiro, RJ, Brazil

<sup>□</sup> CIMAP-CIRIL-Ganil, Boulevard Henri Becquerel, BP 5133, F-14070 Caen Cedex 05, France

**Synopsis** The radiolysis of a mixture of acetone and nitrogen condensed at 13 K by 40-MeV  $^{58}\text{Ni}^{11+}$  ions was studied. The bombardment with heavy ions is highly efficient for inducing chemical reactions in ices. The dissociation rate of acetone mixed with nitrogen as a function of the fluence is determined from a sequence of infrared spectra. The formation of new molecular species due to the irradiation is investigated and their cross-sections are calculated

The  $\text{N}_2$  molecule, formed by one of the most abundant elements in the Universe, is the most common constituent of Earth's modern atmosphere. It is also a major component of the atmosphere of Saturn's moon Titan and has been detected in trace amounts in the atmospheres of Venus and Mars. In acetone ( $\text{CH}_3\text{COCH}_3$ ) the C=O link, which also occurs in several molecules of biological interest, is present. The mixture of these two molecular species,  $\text{N}_2:\text{CH}_3\text{COCH}_3$ , causes asymmetries in the nitrogen molecule, which enhances the IR absorption and allows its study by FTIR spectroscopy. Moreover, the cosmic ray - ice interaction can be simulated and analyzed by irradiating the  $\text{N}_2:\text{CH}_3\text{COCH}_3$  ice in laboratory [1].

Therefore,  $\text{N}_2:\text{CH}_3\text{COCH}_3$  ice (1:1) was irradiated with 40 MeV  $^{58}\text{Ni}^{11+}$  ions, and FTIR spectra were obtained at certain fluences. Figure 1 shows spectra of  $\text{N}_2:\text{CH}_3\text{COCH}_3$  before (dotted line) and after (solid line) irradiation. Daughter molecules resulting from the induced chemical reactions were identified; from the dependence of the molecular abundance, the evolution with fluence of destruction and compaction cross sections of the ice was determined. The average value of  $2.2 \pm 0.4 \times 10^{-13} \text{ cm}^2$  was obtained for the average destruction cross-section determined via seven IR bands. At the beginning of irradiation, associated with ice compaction, the presence of  $\text{N}_2$  accelerates the process of acetone destruction. However, for high fluences, the structural rearrangement caused by  $\text{N}_2$  reduces the radiolysis rate compared to pure acetone [2].



**Figure 1.** FTIR spectra of  $\text{N}_2:\text{CH}_3\text{COCH}_3$  before (dotted line) and after (solid line) irradiation. Some corresponding vibrational modes are indicated.

### References

- [1] A. L. F de Barros *et al* 2014 *MNRAS* **438**, 2026–2035
- [2] Diana P. P. Andrade *et al* 2014 *MNRAS* **444**, 3792–3801

<sup>1</sup>E-mail: [katianne.alcantara@gmail.com](mailto:katianne.alcantara@gmail.com)

