

Ion chemistry in helium droplets doped with adamantane

M. Goulart[†], M. Kuhn[†], L. Kranabetter[†], A. Kaiser[†], J. Postler[†], M. Rastogi[†], A. Aleem[‡], B. Rasul[§], D. K. Bohme^{1*}, and P. Scheier^{2*†}

[†] Institut für Ionenphysik und Angewandte Physik, Universität Innsbruck, Technikerstrasse 25, A-6020 Innsbruck, Austria

[‡] LINAC Project, PINSTECH, P.O. Box Nilore, Islamabad 44000, Pakistan

[§] University of Sargodha, 40100 Sargodha, Pakistan

*Department of Chemistry, York University, Toronto, Ontario M3J 1P3, Canada

The technique employing helium droplets as nano reactors has received flurry of research after Scheidemann et al. in 1990, demonstrated the potential of helium droplets to capture foreign species [1]. The technique is intriguing in a way that it delivers an extraordinarily cold environment, which can be attributed to the superfluid matrix. Further, the ultra-high vacuum facilitates inert and exceptionally clean environment. Additionally, this technique is promising since it opens the door for clean synthesis of nanoparticles without involving solvents, ligands or additives [2, 3].

The aim of this contribution is to deliver insights into the electron interactions with pristine and doped helium droplets and subsequent ion molecule reactions for cations, dications, and trications of large clusters of adamantane [4]. Energetic He species (He*, He+, or He*-) were involved in the ionization, through one or more collisions with helium droplets.

Adamantane has been the choice of molecule as it has the reputation of being the building block of diamondoids and perhaps diamonds.

The aggregation of adamantane has been explored in its ionized form near 0 K in helium droplets.

Magic number (m/z ratio) as obtained by high-resolution mass spectrometry, exhibited the packing of adamantane molecules into cluster structures of special stability involving preferred arrangements of these molecules. No relation between abundance anomalies and charge state could be observed. The spectrum revealed some dehydrogenation of adamantane and its clusters. Nevertheless, no major transformations into adamantoids or microdiamonds could be seen.

References

[1] A. Scheidemann *et al.* 1990 *Phys. Rev. Lett.* [64 1899](#)

[2] G. Haberfehlner *et al.* 2015 *Nat. Comm.* [68779](#)

[3] J. Postler *et al.* 2015 *J. Phys. Chem. C* [11920917](#)

[4] M.K. Goulart *et al.* 2016 *J. Phys. Chem. C* [6b11330](#)

¹E-mail: dkbohme@yorku.ca.

²E-mail: paul.scheier@uibk.ac.at.