

Chemistry in Deep Space

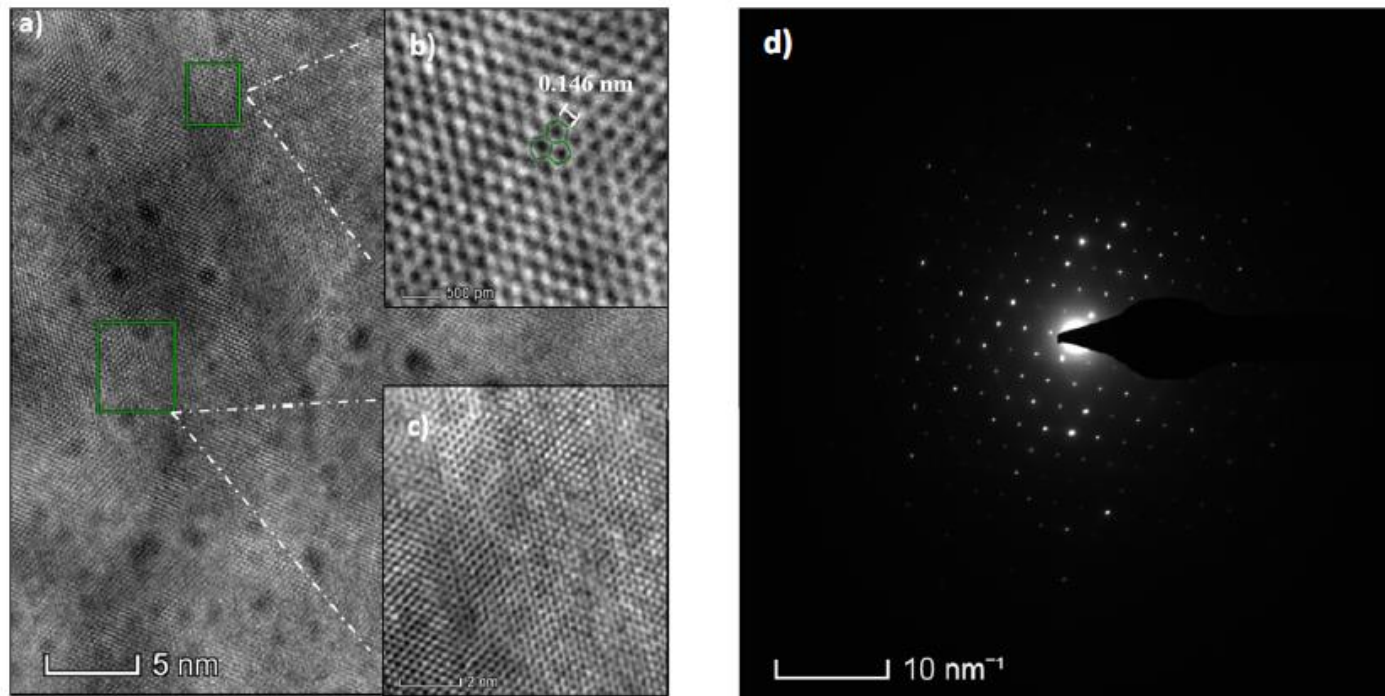


Figure – High Resolution Transmission Electron Microscope (HR-TEM) image of Nitrogen-doped graphene sheet synthesized at 4 K using 9 eV photon irradiation of benzonitrile ice; (a) a large sheet, (b) and (c) show the hexagonal pattern in two different parts of the large sheet, and (d) the corresponding diffraction pattern.

Beyond our solar system lie those vast regions of the interstellar medium (ISM), the ‘chemical factories’ for over 250 molecules. It is now apparent that much of the chemistry of the ISM arises from heterogeneous chemistry on icy surfaces of dust grains. For example these icy mantles provide the environment for the formation of molecular hydrogen - the most abundant molecule in the universe – through the recombination of atomic hydrogen, similarly surface (heterogeneous) chemistry is believed to be responsible for the assembly of more complex molecules e.g. H_2O , H_2S , CH_3OH , OCS , OCN ... In addition these mantle ices are always being processed by ultraviolet radiation, cosmic rays or stellar winds. This processing changes the basic composition of the ices and causes some complex organic refractory residues to form. Indeed in the modern field of astrobiology it is in these regions that the prebiotic material necessary for the origins of life are believed to form.