

New noble gas chemical compounds created

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Chemical compounds consisting of noble gases combined with hydrocarbon molecules – a feat previously thought to be unattainable – have been created as the result of the work of researchers at the Hebrew University of Jerusalem.

This achievement by Benny Gerber, Saerree K. and Louis P. Fiedler Professor of Chemistry, and his associates at the Hebrew University Institute of Chemistry opens the way for further research to produce new chemical compounds in such areas as anesthesiology and high-energy fuels that will be more efficient, safer and ecologically less injurious than materials now in use.

Until now, the "laws" of chemistry decreed that the noble elements, including the gases helium, neon, argon, krypton, xenon and radon, which are found on the right-hand side of the periodic table, have a special status. These elements have inert atoms which do not combine chemically with other atoms, except under conditions of extreme energy being applied to release their electrons.

This observation, described towards the end of the 19th century, was explained with the development of quantum theory about 70 years ago, when it was discovered that the inertia of the noble gas atoms derives from their closed and stable electronic shells, which makes these atoms practically impervious to chemical reactions with other atoms.

A major development in "breaking" these electronic shells in order to achieve molecular combinations was accomplished in the 1960s, but only with great difficulty and for a only a few extremely potent reagents,

such as fluorine. This limited the types of compounds that could be made and their potential applications.

Since then, the search for new compounds involving noble gases has continued and has represented a significant scientific challenge with great promise.

An important breakthrough in this field was achieved by Prof. Gerber of the Hebrew University when he predicted, on the basis of theoretical calculations, the existence of a new chemical "family" made up of noble gas atoms and hydrocarbons.

Operating on the basis of Prof. Gerber's theories, leading scientists in Finland (Prof. Markku Rasanen and coworkers) and in Moscow (Prof. Vladimir Feldman and others) succeeded in producing the new compounds in their laboratories. The process by which these compounds were obtained was relatively much easier than in previous attempts, without having to resort to the techniques used in the past involving undesirable, extremely reactive materials.

The combining of noble gas atoms with basic organic molecules (hydrocarbons) is an accomplishment which has aroused great interest in the international chemical community and opens the way for new varieties of chemical derivatives utilizing these gases. For example, the gas xenon, which does not have any negative physiological effects, could be used to produce new anesthetic compounds. Another possible use would be the production of new fuels that would be more energy efficient and less polluting than those now in use. Other applications could be in the creation of any number of new chemical-based products used in industry, medicine or agriculture that would be less polluting of the environment than materials currently used.

Source: Hebrew University of Jerusalem

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