Jean Rouxel

An obituary

Jean Rouxel suddenly passed away on 19 March 1998. He was one of the leading solid state chemists in the world. Jean Rouxel was also an important personality in French science, being heavily involved in the activities of the French Academy and the CNRS.

Jean Rouxel was born on 24 February 1935. He had his university education in Rennes where he received his first degree in mathematics, physics, chemistry and biology. He obtained his doctorate degree from the University of Bordeaux working with Professor Paul Hagenmuller. He started his professional career at Nantes in 1963 and rose to the rank of full professor in 1972. He founded the Institute of Materials Chemistry, of which he was Director till 1997. The work of Jean Rouxel and colleagues in the Institute drew worldwide attention and the Institute became famous as an outstanding centre for research in solid state and materials chemistry.

The scientific work of Jean Rouxel was essentially based on three major themes: (i) synthesis of new phases, many of which were low-dimensional solids or resulted from *chimie douce* processes, (ii) understanding of the chemical bond, through the observation of fluctuations in bonding (charge density waves) in inorganic chains, as well as through the study of redox competitions between anions and cations, and (iii) study of the reactivity of solids, in the light of their band structures and concepts in relation to *chimie douce* (soft chemistry) routes to solids.

Low-dimensional solids were of primary interest to Rouxel. These solids are actually infinite one- or two-dimensional molecules and are stable only when bonds are weakly ionic, thereby justifying the use of orbital diagrams as in molecular chemistry. Furthermore, physical properties of these solids, such as layered compounds, are not described by a simple transcription of the laws of three-dimensional space. A good example is the charge density wave (CDW) instability found in low-dimensional conductors as a consequence of the Fermi surface displaying large parallel sections. Fundamental contributions to this domain were made by Rouxel. New compounds were designed to support theories, while others opened up new areas. $NbSe_3$ was the first compound in which two charge density waves were found, and in which a depinning of a charge density wave was first observed. TaS_3, with its two polytypes, was the subject of a study on the influence of commensurability on the threshold field associated with the depinning of charge density waves. The tetrachalcogenoiodides $(MeSe_4)_nI$ (M = Nb, Ta) resulted from efforts to control the filling of the conduction band, and hence the **q** vector of the CDW.

$(NbSe_4)_{10}I_3$ showed, for the first time, a memory effect in the depinning process. $(TaSe_4)_2I$ was used to study the 'noise' generated by the motion of the CDW.

$Ta_4P_4S_{29}$, an inorganic compound with intertwined double helices, was discovered as early as 1985. This compound illustrated a separation of functions in intercalation chemistry of the Ta_2PS_6 framework by restricting the geometrical conditions and with a sulphur helix providing redox centres.

This competition between the cationic *d* orbitals and the anionic *sp* block provided Rouxel, a means to describe the subtle variations in layered compounds, the trends in three-dimensional systems such as the pyrites, and the fluctuations in the transition between these two groups. A mechanism was provided by him for metal clustering in layered compounds, occurring along with anion association. This was the beginning of the chemistry of holes, as opposed to the chemistry with electrons, a chemistry largely dealing with antibonding states. Here, the association of anions occurs along with the clustering of cations. The redox *chimie douce* through deintercalation processes was interpreted in relation to the stability of holes at the top of *sp* bands with anion character. Neutralizing holes with electrons allows to stabilize unusual structural types. The hole–electron interplay in chemistry of solids is one of the main areas that Jean Rouxel had been investigating in recent months.

Jean Rouxel was meticulous and thorough in everything he did. He championed excellence. He was the author of more than 300 research papers and his books, *Crystal Chemistry of Materials with Quasi One-Dimensional Structure* and *Soft Chemistry Routes to New Solids* were both influential.

Jean Rouxel was a member of the French Academy of Sciences and was a recipient of many awards and honours, including the medaille d'or of CNRS and the title of Commandeur des palmes academiques. He was a member of the American Academy of Arts and Sciences and Academea Europea. He was elected to the prestigious professorship of College de France in 1996, a truly great honour indeed.

Jean Rouxel visited India a few times and was an Honorary Fellow of Indian Academy of Sciences. He came specifically to deliver a named lecture at the Indian Institute of Science two years ago. The unexpected death of Jean has shocked the chemistry community as a whole. He will be missed dearly by many friends, colleagues and admirers.

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