40 years SON

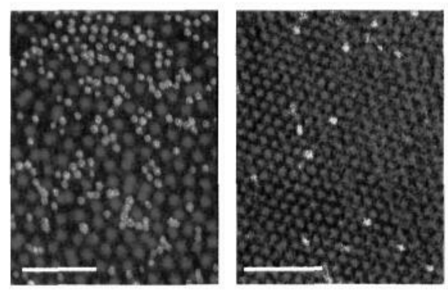
RESEARCH TOPICS

SON stimulates advanced basic and strategic chemical research at universities in the Netherlands. Next pages will show examples of excellent research sponsored by SON. The subjects vary from physical inorganic chemistry, organic synthesis and supramolecular systems to procestechnology and environmental research. Chemical scientists write about their fascinating studies. They apply confocal scanning light microscopy to show that **colloidal particles** behave like very large atoms (*H.N.W. Lekkerkerker*). **Laser spectroscopy** enables chemists to fulfill the long-standing dream of watching molecules in action (*D.A. Wiersma*). Advanced chemical synthesis leads to macromolecules such as **dendrimers** with a well-defined architecture (*E.W. Meijer*) or **clip molecules** that are shown to induce liquid crystallinity after clipping to polymers or porphyrins (*R.J.M. Nolte*). In less than one hunderdth of a second the world's first **all-ceramic lithium battery** was recently produced (*J. Schoonman*). Chemical engineers study **catalytic processes** on molecular scale (*J.W. Niemantsverdriet*), develop **catalysts** for the conversion of CFC's into useful products (*M. Makkee*) and they design **non-permselective catalytic membrane reactors** for fast exothermic reactions (*W.P.M. van Swaaij*). Vanadium haloperoxidase provides **novel biocatalysts** (*R. Wever*) and buckyballs show to pass the sigma-pi symmetry barrier to **electron transfer** (*J.W. Verhoeven*). To learn more about the working mechanisms of biological systems, chemists study enzymes in frozen action (*B.W. Dijkstra*) and the dynamics and structures of **proteins-DNA complexes** by using NMR-spectroscopy (*R. Kaptein*). Finally, drug-designers use the specificity of ligand-interaction to develop **target drugs** (*J.H. van Boom*). Thirteen exciting chemical stories.

COLLOIDS AS ATOMS

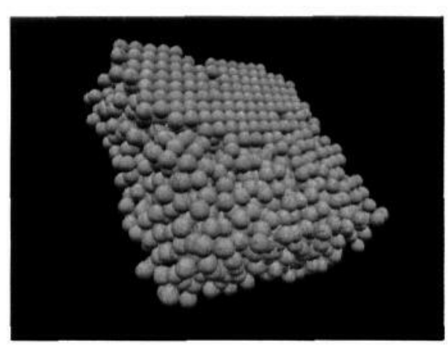
We have no doubt about the existence of atoms and molecules today. We can 'see' them using scanning tunneling or atomic force microscopy. At the beginning of this century, the reality of atoms was still a matter for debate. In 1907-1913 *Jean Perrin* resolved the issue with brilliant yet simple experiments. Using an ordinary light microscope he studied the behaviour of about 1-μm, spherical, colloidal particles suspended in water. Perrin showed that colloidal particles behave like very large atoms.

ow, at the end of the century, Perrins view of colloids as atoms lives again. Whereas Perrin studied dilute suspensions, the analogue of an ideal gas of atoms, the modern emphasis is on concentrated suspensions where the particles may occupy 50% or more of the total volume of the suspension. The development of 'model' colloidal particles, having well defined size, shape and interactions as well as special magnetic, electric and optical properties, besides development and improvement of techniques such as light, X-ray and neutron scattering, allow quantitative experiments on the structure and dynamics of colloidal suspensions.



(From N.A.M. Verhaegh and A. van Blaaderen, Langmuir 10,1427,1994).

Confocal Scanning Fluorescence Microscopy pictures of a binary colloidal dispersion. The photographs show the structure of a freshly prepared dispersion (left) and the same dispersion 15 days later (right). The binary colloidal dispersion contains silica spheres with radius of 492 nm and 215 nm, labeled with fluorescein-isothiocyanate and rhodamine-isothiocyanate, respectively. Both fluorophores were excited and detected simultaneously. (The bar represents 5 μm).



(From A. van Blaaderen and P. Wiltzius, Science 270, 1177, 1995).

Real space structure of glass and crystal of colloidal silica spheres quenched from a concentrated dispersion with a centrifugal force. The structure was determined using Confocal Scanning Fluorescence Microscopy . The colloidal silica spheres have a fluorescein-isothiocyanate core of a radius 200 nm and a total radius of 525 nm. The red box represents a volume of 16.3 x 16.3 x 6.8 μm.

Van 't Hoff Laboratory of the Utrecht University, having over more than 80 years a standing tradition in the physical and colloid chemistry, started in the mid seventies with studying silica model colloids. In addition of providing these particles with steric stabilizing coatings to manipulate interactions, over the last few years, research placed emphasis on preparing particles with special magnetic and fluorescent cores. By using confocal fluorescence microscopy, new and exciting results have been obtained about crystallisation and colloidal structures.

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