PREPARATION BY SOFT CHEMISTRY OF ORGANO MINERAL LAMELLAR COMPOUNDS USABLE TO OBTAIN CATALYSIS AND MAGNETIC POWDERS

Fact Sheet

Project Information

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Project closed

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Research programme (EEC) on materials (raw materials and advanced materials) - Advanced materials (EURAM) -, 1986-1989

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No data

EU contribution
No data

Coordinated by
Institut de Physique et Chimie des Matériaux
France

Objective

The aim of the present project is to use a soft chemistry approach to prepare new organic-inorganic layered materials with potential applications in the domain of heterogenous catalysis or magnetic pigments. This work associates organic chemists, solid state inorganic chemists and physicists. The starting materials are layered transition metal oxihalides (and not silicates, or graphite, or layered dichalcogenides as usual). The FeOC1 structure is built up of two alternate metal-oxygen layers sandwiched by a double layer of chlorine atoms. At low temperature (and most of the time at room temperature) topochemical reactions will be carried out in order to replace the external chlorine layers by organic groups of organometallic or mineral complexes. For example at 60C: FeOC1+RK-FeOR+KC1 (R = alkyl, aryl). The cracking of a phase such as FeO(OCH3) will lead to Fe2O3 which is a new way to get this pigment Baryum derivatives such as Ba(OC2H5)2 will be used with the aim of getting BaFe12O19. The reaction: 2FeOC1+Fe(CO)4K2 -(FeO)Fe(CO)4+2KCA that is being tested in the laboratory of Nantes should lead to Fe(CO)4 tetrahedra between infinite (FeO) layers. The cracking of Fe(CO)4 groups by heating under vacuum will be studied in order to get 'in situ' Fe aggregates. The grafting of phosphoric acids at room temperature in acetronitrile will be used to prepare new catalysts, with -R phosphonic groups dangling in a FeOR configuration between FeO layers.

Grafting and pillaring in oxyhalides have provided a new class of materials which can be molecularly engineered for potential applications. These compounds occupy a position somewhere a position somewhere between inorganic and organic chemistry and the structure of the host lattice remains unchanged. Thermal stabilities, which depend on the organic group, range from 250 to 500 C.

In the case of reactions between iron oxygen chloride and phosphonic acids chemical processes modify the structure of the inner layer. The reaction process probably consists of an interealation step followed by a substitution of the chlorine atoms via the phosphoryl group with a concomitant breakdown of the iron oxygen iron network by the conjugated action of the hydroxyl groups and the hydrogen chloride eliminated during the reaction. The same reactions are difficult starting from other materials such as feric oxide, ferric chloride or iron sulphate.

Extension of the synthetic chemistry of derivatized layer iron phosphonates is in progress by studying the effects of the substituents borne by various phosphoric acids and the possibility of making specific organic reaction in their interlayer space especially when functional organic groups are bound to phosphorus. Chemical and geometrical variations of the structure can be controlled leading to a large scope of potential applications (catalysis, polymer additives, coating fibre, molecular sieves, etc).

THE STARTING MATERIALS ARE LAYERED TRANSITION METAL OXIHALIDES (NOT SILICATES, OR GRAPHITE, OR LAYERED DICHALCOGENIDES). THIS ALLOWS SPECIFIC REACTIONS AND INTRODUCES MAGNETIC PROPERTIES.

NMR MEASUREMENTS WILL BE CARRIED OUT AT NOTTINGHAM UNIVERSITY WHERE ALL NECESSARY EQUIPMENT EXISTS AND INCLASTIC NEUTRON SCATTERING AT ILL GRENOBLE AND AT THE ISIS PULSED NEUTRON SOURCE AT THE RUTHERFORD APPLETON LABORATORY.

THE COMPLEMENTARY TECHNIQUE OF INELASTIC NEUTRON SCATERRING (INS) IS INCLUDED AS IT IS MOST SUITABLE AT HIGH TEMPERATURES WHEN THE THERMALLY ACTIVATED HOPING RATE IS LARGE ENOUGH TO EXCEED THE INSTRUMENTAL RESOLUTION LIMITATIONS.

THE SUCCESSFUL FABRICATION OF ORGANIC-MINERAL LAMELLAR COMPOUNDS ("PILLARED COMPOUNDS") SHOULD FIND INDUSTRIAL APPLICATION IN THE FIELD OF HETEROGENEOUS CATALYSTS AND MAGNETIC PIGMENTS.

Fields of science (EuroSciVoc) ℹ

natural sciences > chemical sciences > organic chemistry > **organic reactions**

natural sciences > chemical sciences > **polymer sciences**

engineering and technology > materials engineering > **coating and films**

natural sciences > chemical sciences > inorganic chemistry > **halogens**

natural sciences > chemical sciences > **catalysis**

ℹ

Programme(s)

FP1-EURAM - Research programme (EEC) on materials (raw materials and advanced materials) - Advanced materials (EURAM) -, 1986-1989

Topic(s)

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Call for proposal

Data not available

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CSC - Cost-sharing contracts

Coordinator

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Links

Contact the organisation ↗ Website ↗
HORIZON collaboration network

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