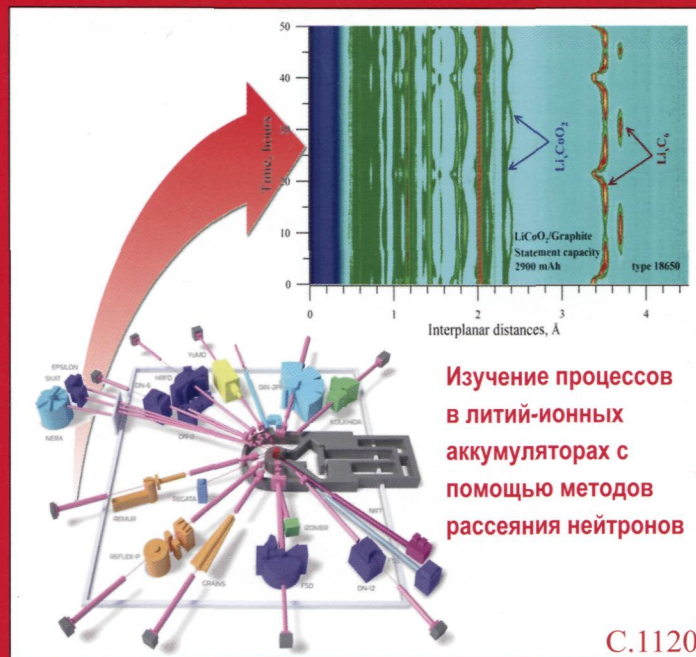


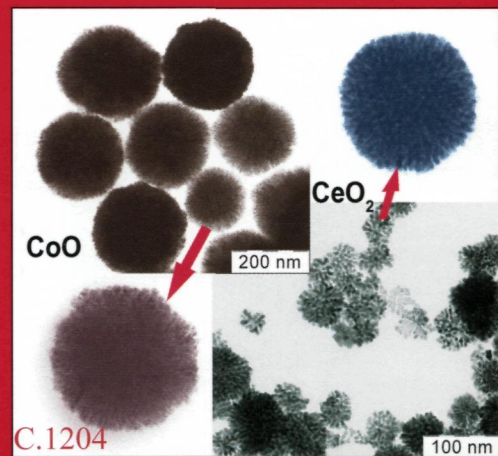
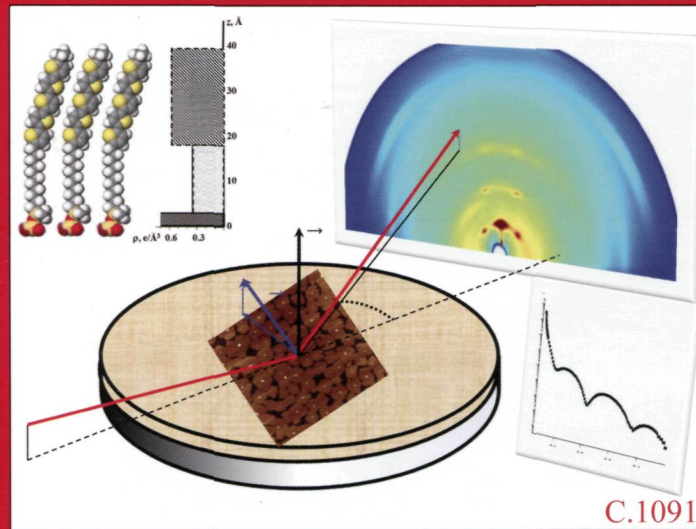
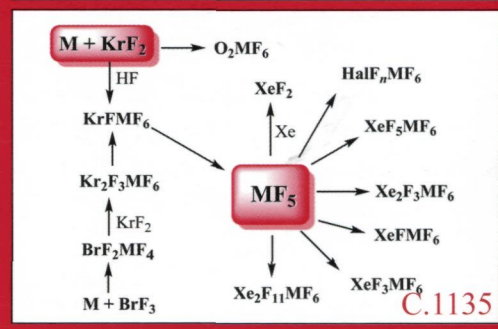
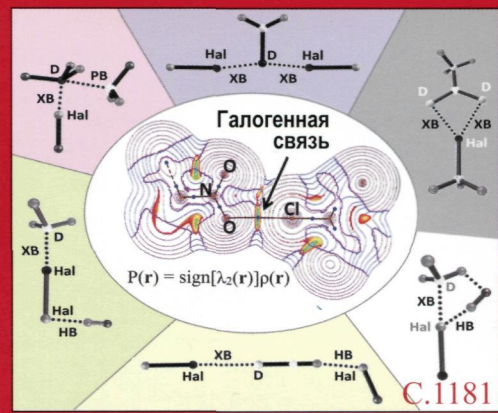


Российская академия наук

# Успехи ХИМИИ



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Международный год кристаллографии

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### 2014 — International year of crystallography

M.V.Kovalchuk

*National Research Centre «Kurchatov Institute», Moscow, Russia*

#### **Modern approaches to the investigation of thin films and monolayers: X-ray reflectometry, grazing incidence scattering and X-ray standing wave method**

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M.A.Shcherbina,<sup>a,b</sup> S.N.Chvalun,<sup>b,c</sup> S.A.Ponomarenko,<sup>a</sup> M.V.Kovalchuk<sup>c</sup>

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Modern experimental approaches to the investigation of thin films and monolayers based on the effect of total internal reflection of X-ray radiation from the substrate (X-ray reflectometry, grazing incidence scattering and X-ray standing wave method) are described. Their potential is demonstrated by considering a number of studies of organic macromolecular systems possessing semiconducting properties, which are promising as thin-film transistors, light emitting diodes and photovoltaic cells. It is shown that using a combination of the above-mentioned methods, it is possible to investigate the structure of thin film materials and structure formation processes in them with high accuracy and thus to obtain information needed to improve the efficiency of organic electronic elements. Bibliography — 92 references.

#### **Neutron scattering for analysis of processes in lithium-ion cells**

1120

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The review is concerned with analysis and generalization of information on application of neutron scattering to study the structure of materials for small-size power sources (mainly lithium-ion cells) and the structural rearrangements in these materials occurring in the course of electrochemical processes. Applications of several key methods including neutron diffraction, small-angle neutron scattering, inelastic neutron scattering, neutron reflectometry and neutron microscopy are considered. Information on modern neutron sources is presented and a number of typical experiments are outlined. The results of studies of lithium-containing materials for lithium-ion cells carried out at the IBR-2 pulsed reactor are discussed. Bibliography — 50 references.

#### **Molecular and crystal structures of noble gas compounds**

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Data on the structures of xenon and krypton compounds in various aggregative states are analyzed and integrated. The structures of simple, coordination, polymeric and clathrate-like compounds of these elements with various types of bonds are considered. Characteristic features of their vibrational spectra are discussed in relation to structural transformations caused by cation–anion interactions, structurally non-rigid intramolecular rearrangements and other factors. Bibliography --- 332 references.

## **Interplay between non-covalent interactions in complexes and crystals with halogen bonds**

1181

E.V.Bartashevich,<sup>a</sup> V.G.Tsirelson<sup>b</sup>

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Studies on the structure and properties of complexes and crystals with halogen bonds accompanied by alternative or secondary non-covalent interactions are analyzed. The features indicating the presence of halogen bonds are described systematically, modern methods and approaches that provide clear and reproducible estimates of the strength of halogen bonds in comparison with the strengths of other non-covalent interactions are considered. Problems that give rise to contradictions in the interpretation of the results of different comparative studies of the strength of halogen bonds are discussed.

Bibliography — 249 references.

## **Oriented aggregation of particles: 100 years of investigations of non-classical crystal growth**

1204

V.K.Ivanov,<sup>a, b</sup> P.P.Fedorov,<sup>c</sup> A.E.Baranchikov,<sup>a</sup> V.V.Osiko<sup>c</sup>

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The results of investigations of non-classical crystal growth by the oriented aggregation mechanism are integrated. The data published since the end of the 19th century are considered, the attention being focused on analysis of publications of the last 15 years. The information on the characteristic features of the oriented aggregation of particles is described systematically. The experimental methods used to elucidate the regularities of non-classical crystal growth, including in situ methods, are discussed. The prospects of application of the oriented aggregation of particles for the formation of various materials are demonstrated.

Bibliography — 227 references.