Laboratory of Radioanalytical and Electrochemical Methods

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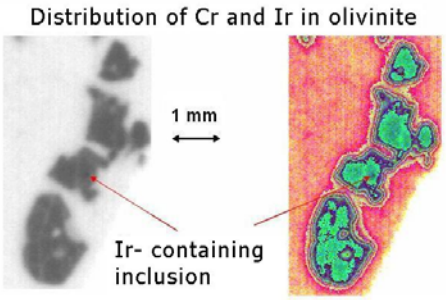
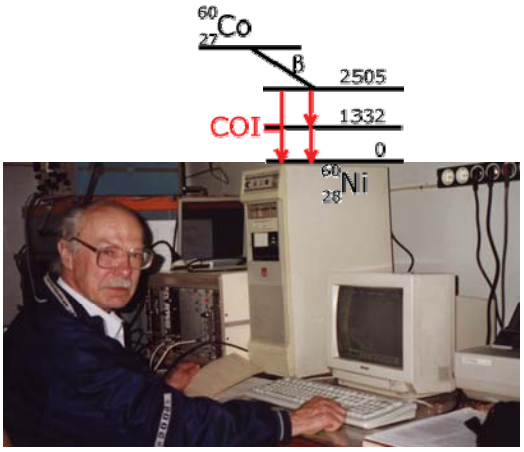
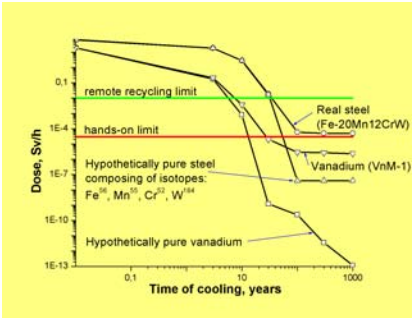
This is one of the oldest laboratories, which was formed in 1949. The former header I.P.Alimarin (academician and head of the soviet analytical chemistry) fruitfully directed laboratory during 40 years. Since 1989 V.P.Kolotov headed the laboratory. The laboratory have played an appreciable role in making and development of new methods for trace analysis, which ensured development of new high purity materials for nuclear technology and electronics as well as provided noticeable progress of geochemistry, cosmochemistry and other sciences. It is in this laboratory have been carried out the first investigations on neutron activation analysis, performed unique works on ultra micro analysis, developed methods of radioisotope dilution, stripping voltammetry and many others. Many prominent analysts came from the laboratory.
In the recent years the scientific activity of the lab is focused on the development of activation and electrochemical methods for determination of micro- and macro-components in the samples of various nature, elaboration of environmentally more safe structural materials for nuclear technology, application of information technologies for modeling, processing and presentation data, investigation of impact of nuclear particles radiation for modification of crystals and other directions. The main results are the next:

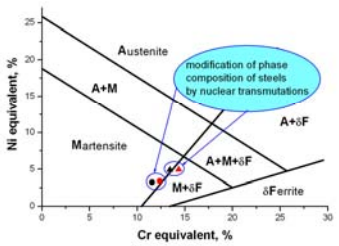
- A large number of neutron- and gamma-activation methods for high sensitive analysis of pure substances, geological and environmental samples, including determination of traces of C, N, O in the solid samples.
- A method of digital gamma-activation autoradiography has been developed for investigation of the spatial distribution of micro inclusions containing platinum group elements in silicate samples. High sensitivity of the method and some other features make it effective instrument for screening analysis of silicates thin sections.
- Original algorithms and program package (ASPRO-NUC) have been developed for precision analysis of complex semiconductor's gamma-ray spectra, isotope identification, consideration of true coincidence effect (in the case of measurement of cascade radionuclides in voluminous samples) and making of NAA. The developed software is linked with modern system for information management and treatment on the basis of relational data base. The system represents the first LIMS for activation analysis and gamma-ray spectrometry.



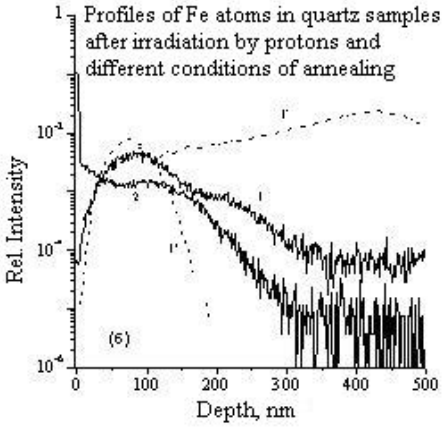


- Main principles of development of environmentally more safe structural metallic materials (austenite and ferrite steels, vanadium alloys) have been suggested in the course of theoretical and experimental investigations. The new materials are distinguished by faster decay of the induced radioactivity and are intended for nuclear installations (both fusion and fission reactions). For estimation of nuclear transmutations in materials while irradiation by neutrons having arbitrary distribution, the first Russian program (ACTIVA) has been developed. The influence of nuclear transmutation caused by neutron irradiation on phase stability of some metallic materials has been investigated. It has been shown that in some cases these effects may control phase stability of materials. This work is carried out in collaboration with IMET RAS.





- Modification of silicate crystals under irradiation by protons or deuterons has experimentally investigated. By means of numerical and experimental modeling the radiation induced migration of carbon and some rock constituent elements in natural crystals under different temperatures (similar to space conditions) has been studied. These investigations should clarify the processes of forming of cosmic dust, make prognosis on its chemical and phase composition and evolution.



- High precision coulometric methods for determination of high metals concentrations (up to 100%) in different samples with accuracy and reproducibility at the level of decimal fraction of percent have been developed. Among them are determination of some noble elements (Au, Ag, Ir, Pt, Pd) in various alloys, concentrates, medical and cosmetic samples; determination of Tl, Cu, Bi, Pb, Hg, Cd, Ba, Ca, Re, Cr, V, Ni and their oxidation states in high temperature superconductors. The metrological characteristics of the developed methods do not concede the possibilities of the gravimetric method, moreover in some cases exceed them. The strong advantage of coulometric method is its lower laboriousness and time consumption.

I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	0
H			Voltammetry												He
Li	Be		Coulometry							B	C	N	O	F	Ne
Na	Mg									Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt									

Voltammetric and coulometric methods for determination of the selected elements developed in the laboratory

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The laboratory actively takes part in development of Internet resources in analytical chemistry using the novel information technologies. One can refer to portal “Analytical Chemistry in Russia” (www.rusanalytchem.org) and some others.