

BIBLIOGRAPHY

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Review of the book 'Laser Isotope Separation in Atomic Vapours' by P.A. Bokhan, V.V. Buchanov, D.E. Zakrevskii, M.A. Kazaryan, M.M. Kalugin, A.M. Prokhorov, N.V. Fateev (Moscow, Fizmatlit, 2004; ISBN 5-9221-0497-7)

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J. Robier and J. Eclaire estimated the prospects offered by the high monochromaticity of laser radiation already in 1963 and were first to propose a universal scheme for the laser-assisted separation of molecular isotopes. Its versatility is provided by a preliminary selective excitation of particles to a more stable state, which is characterised by a longer lifetime and allows subsequent transformations without a selectivity loss. This scheme provided for a breakthrough in the production of a number of enriched elements. In his forecasts of the development of science in late 1970s, P.L. Kapitza predicted a wide use of isotopically pure materials in solid-state physics and other fields. This prediction is being presently realised due to the development of laser isotope separation methods.

Compared to other techniques, laser methods for isotope separation are attractive for many elements, since they are simpler and the final product is less expensive. Laser separation of isotopes has recently become practicable in weight amounts due to the development of narrowband tunable high-average power (~ 10 W) lasers capable of coperating ontinuously for several days without preventive maintenance.

The book considers several approaches to the problem of laser isotope separation in atomic vapours of various elements. Much attention is devoted to the novel techniques. In particular, the results of studies of the photoionisation and photochemical methods, which are based on a coherent isotope-selective two-photon excitation of atoms, are presented. A method for separating weight amounts of zinc isotopes using a two-photon excitation in counterpropagating laser beams under conditions in which the isotope structure of the resonance transition is completely hidden by the Doppler broadening is described.

A method for obtaining isotopically modified products using reactions of selectively single-photon excited atoms changing to long-lived states in a gas flow is also presented. Its main advantage is the possibility of separating isotopes at a high concentration of the working substance in the separation chamber and using a single transition instead of three or four transitions in the conventional photoionisation technique. This appreciably reduces the product cost. A detailed mathematical and experimental description of the process of separating weight amounts of zinc and rubidium isotopes is given as an example.

The quantitative results of the state-of-the-art studies of photochemical reactions of electronically excited atoms with molecules and various other processes occurring during laser isotope separation are also presented.

The applications of isotopically purified products in medicine, biology, microelectronics, optoelectronics, nuclear-fuel cycle, etc., are comprehensively described.

The principles of designing and features of operation of modern Russian and foreign high-mean-power tunable laser systems are described, and their output characteristics are presented. The costs of the products obtained by different laser isotope separation methods are estimated for several elements.

The results presented in this book substantially supplement the data considered in previous monographs. This book is quite opportune and can be useful for researchers, engineers, postgraduates, and students.

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