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γ-activation digital autoradiography of large samples. Equalization of activating dose over the microtron-irradiated sample surface

Gamma-activation autoradiography is an effective method for revealing of features of noble elements distribution in geological samples [1]. Because the activating field of microtron bremsstrahlung displays sharp depression of intensity, the area of the analyzed samples usually should not exceed 1 cm². However, analysis of such relatively small samples may be done with success by means of other instrumental methods such as SEM or X-ray microanalysis. To increase the competitiveness of gamma-activation autoradiography we suggest to use it for screening analysis of the large area samples (10-30 sm²), just for detection of "zones of interest" (for example, containing noble elements micro inclusions) implying their further detailed analysis by appropriate instrumental method. Equalization of the activation field over the sample surface may be done by suitable sample movement. The suggested kinematic scheme of the irradiation device assumes rotation of the sample and its simultaneous reciprocating moving. Scheme realization is simple enough to provide reliable functioning of the device in strong radiation field.

Until working out the real device construction the computer modeling of dose acquisition during activation has been done. Program "Dose Modeling" estimates the uniformity of the acquired dose at different parameters of the sample movement. It has been shown that the offered kinematic scheme provides considerable smoothing of a dose over a surface though a certain residual non-uniformity of a dose still remains. For full "equalization" of the activation dose it has been suggested to use mathematical pixel-by-pixel correction of the autoradiogram image by means of the developed software ("Dose Correction"). For such correction a copper disk-monitor should be irradiated together with the sample. The program computes the parameters of the distribution of the acquired activation dose of the disk-monitor. (single or superimposed Gauss distributions) and correct the autoradiogram image of the analyzed sample. The disk-monitor autoradiogram image is also treated by the program to estimate the quality of dose correction. By means of program "Dose Modeling" the optimal working parameters of the device are defined: the ratio of frequencies of the sample rotation to reciprocating moving should be not less than 5.5; duration of an irradiation should be not less than 300 seconds. The device for an irradiation of samples has been made and tested. It consists of a platform making reciprocating moving by the alternating current motor through the crank mechanism; on the platform are located the holder of the sample and the second motor rotating the sample. Results of experimental check of the developed irradiation system have confirmed completely its working capacity.

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