Mintek reports

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● Report M48

Tracer tests on furnaces at Metalloys Limited.

During 1980, thirteen double tests were carried out with five radioactive isotopes on three furnaces at Metalloys Limited, near Meyerton. Each double test involved the introduction of a sample of coke impregnated with lanthanum and a sample of irradiated manganese ore (^{54}Mn or ^{59}Fe), irradiated quartzite (^{46}Sc), or irradiated coal (^{46}Sc, ^{59}Fe, and ^{60}Co). The tests were conducted on the three large furnaces for the production of high-carbon ferromanganese, viz M10, M11, and M12. The radioactivity of samples of the metal and the slag leaving the furnace was measured by the Isotopes and Activation Division of the Atomic Energy Board. Response curves and computer analyses are presented on the elution of the tracers from the furnaces.

The response curves for the tracers, which were inserted close to the electrodes, are discussed so that the salient differences between their passage through the three furnaces can be established. The results obtained give support to the findings of a dig-out carried out on furnace M10 during 1977. The metal and slag products of furnace M12 were subjected to mineralogical investigation so that the major phases in the furnace products could be determined.

Details of the calculation of the mean residence time for material in furnace M12 are given in an appendix.

● Report M52

A high-speed, multi-input serial-interfacing system for a computer with simultaneous back-up recording on magnetic tape.

A system has been developed that interfaces nuclear-instrument data modules and a multichannel analyser into a computer. The interface converts 4-bit binary-coded decimal (BCD) data into 8-bit packed BCD data, and converts the parallel data into serial data. The data are transmitted up to a distance of 500 m at a transfer rate of 153,6 kbaud via an RS422 transmission link to a central computer system.

One or more multichannel analyser systems can be connected to the system via a routing device. The routing device serves these analysers on a first-come-first-served mode.

The data transmitted to the computer system are recorded simultaneously on a digital magnetic-tape drive to provide a back-up facility.

● Report M53

The development of an automatic sample-changer and control instrumentation for isotope-source neutron-activation analysis.

An automatic sample-changer was developed at the Council for Mineral Technology for use in isotope-source neutron-activation analysis. Tests show that the sample-changer can transfer a sample of up to 3 kg in mass over a distance of 3 m within 5 s. In addition, instrumentation in the form of a three-stage sequential timer was developed to control the sequence of irradiation transfer and analysis.

● Report M69

The determination, by X-ray-fluorescence spectrometry, of tin and tungsten in ores, concentrates, and residues of scheelite, wolframite, and cassiterite.

The method of analysis described is applicable to samples with tin and tungsten contents from 15 p.p.m. to 75 per cent.

For samples containing tin and tungsten in the range 2000 p.p.m. to 75 per cent, the matrix variations are compensated for by the use of briquettes containing coarse river sand, the internal standard, and potassium chloride, the last of which acts as a binder, diluent, and grinding aid. For the samples containing tin and tungsten in the range 15 p.p.m. to 2000 p.p.m., the potassium chloride is omitted. zinc and antimony are used as the internal standard for tungsten and tin respectively. Calibration graphs for tin and tungsten are obtained by the use of standard reference materials for cassiterite and scheelite.

The precision of the analysis for tin ranges from a relative standard deviation of 0,039 at 50 p.p.m. to 0,005 at 75 per cent. The values for tungsten are relatively constant at between 0,015 and 0,008 at concentrations between 50 p.p.m. and 50 per cent.

The lower limits of detection for tungsten and tin by the high-concentration technique of analysis are 202 and 155 p.p.m. respectively, and by the low-concentration technique the corresponding limits are 4 and 2 p.p.m.

The overall time required for the analysis of ten samples by these techniques is approximately 3 hours.

The laboratory method is detailed in an appendix.

● Report M77

Analysis of the results of a marked-ball test in relation to theories of ball wear in rotary mills.

Theories of ball wear are formulated, and it is shown that, in terms of such theories, the difficulties associated with the results of a marked-ball test (so-called because the different types of balls carry distinguishing marks) can be interpreted and resolved.

This type of test is contrasted with the conventional test that is used in the evaluation of grinding balls. It is demonstrated that, in a marked-ball test, several types of ball can be evaluated simultaneously at a much lower cost, and that the results can be used for the estimation of ball comsumption in a mill and for the evaluation of the cost-effectiveness of the grinding balls.