Metallurgist, Vol. 56, Nos. 9–10, January, 2013 (Russian Original Nos. 9–10, Sept.–Oct., 2012)

RECYCLING CHROMIUM-BEARING WASTES

I. K. Ibraev,[1] O. T. Ibraeva,[2] and M. M. Suyundikov[2]

UDC 669.003.011

Results are presented from studies performed to develop practical methods of recovering chromium from the chromium-bearing sludge formed in cleaning chromium-bearing waste water from flat-rolled-products shop No. 3 at the metallurgical plant ArselorMittal Temirtau. Methods are proposed for using the resulting product, which can help solve environmental problems and make good use of secondary material resources.
Keywords: *chromium-bearing sludge, recycling, recovery, secondary material resources, leaching.*

Chromium enters the effluent generated at ArselorMittal Temirtau Metallurgical Plant from spent pickling solutions and water used in the treatment of rolled strip. The pickling solutions and the waste water undergo cleaning with reagents. The part of the cleaning operation that is carried out to remove compounds of chromium (Cr^{6+}) is based on reactions in which bichromate and chromate ions are reduced by Fe^{2+} ions and then treated with milk of lime. These steps convert hexavalent chromium to trivalent chromium, which is allowed to settle together with other metals and forms sludge. The chemical composition of the chromium-bearing sludge is shown in Table 1.

Over 50 companies are dealing with problems related to the neutralization of contaminated solutions after the treatment of metallic surfaces that contain nonferrous metals. An assessment of the associated sludge had shown that it can serve as a source of such metals, and several methods have recently been proposed for systematically recycling them. Electrochemical methods are presently the type of method most commonly used to recover the metals. Reagent-based methods, ion-exchange methods, and other technologies are also being used [1–8].

Chromium is usually recovered by an extractive method, hydrometallurgical extraction in particular [5]. Naphthenic acids of the versatic type, C_7–C_9 fatty acids, and their salts serve as relatively inexpensive extractants. The use of chelates as extractants is not cost-effective, since they are expensive and cannot be regenerated and reused. High productivity can be attained in the recovery of metallic elements in sludge that is being recycled by resorting to selective solubilization in an ammonia-based medium. In this case, iron also remains in the residue as part of the hydroxides that are present. Chromium is selectively solubilized from the residue by oxidation in an alkaline solution with a suitable agent (H_2O_2, Cl_2, $NaClO_4$).

One promising method of regenerating chromium is chloridizing evaporation with the use of solid chloridizing agents. The method provides for the regeneration of substantial quantities of chromium from different source materials and produces a relatively high yield of different metals [6–7].

An electrical treatment method that employs electroosmosis and electrophoresis can be used to recycle sludge after reagent-based cleaning of waste water in order to recover chromium.

One method currently being used to recover chromium is the thermal treatment of sludge in the presence of car-

[1] Eurasian University of Innovation, Pavlodar, Republic of Kazakhstan; e-mail: ibraevik@yandex.ru.
[2] Toraigyrov Pavlodar State University, Pavlodar, Republic of Kazakhstan.

Translated from Metallurg, No. 10, pp. 28–30, October, 2012. Original article submitted March 14, 2102.