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Mechanism of polymetallic concentrate leaching with sulfuric acid and hydrogen peroxide solution

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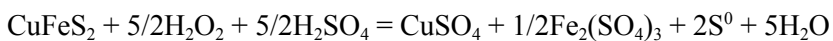
³*University in Belgrade, Faculty of Technology and Metallurgy, Belgrade*

Abstract

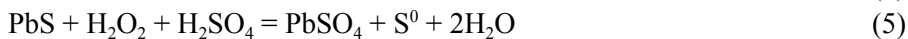
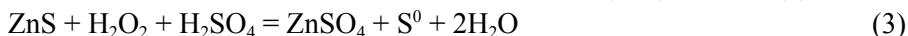
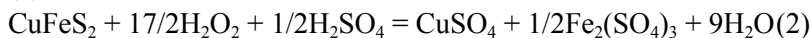
The determination of mechanism of the polymetallic concentrate leaching with sulfuric acid and hydrogen peroxide was done based on the characterization of the starting concentrate and leach residues. The application of XRD and thermal analysis on the leaching mechanism determination was done. The phase content of concentrate and leach residues were determined by X-ray analysis using diffractometer PHILIPS PW-1710. DTA and TG analysis were performed in air atmosphere up to 1173 K on NETZSH, model 409 EP, device.

The polymetallic concentrate, used in experiments, has the following chemical composition (in wt. %): Cu-8.92, Zn-8.79; Pb-12.66, Fe-19.80 and S-21.4. X-ray phase analysis of the concentrate reveals that the sample contains chalcopyrite, sphalerite, galena pyrrhotite and quartz (Fig. a). On Fig. b the DTA and TG curves of polymetallic concentrate are shown. Curves include two parts: first, a low temperature, which correspond to the sulfides oxidation (the mass increase on the TG, and exothermic peaks on the DTA); and second which correspond to the dissociation of sulphates and oxysulphates (the mass loss on the TG, and endothermic peaks on the DTA).

The phases identified in the leach residue by XRD were elemental sulphur, anglesite, chalcopyrite, sphalerite, galena pyrrhotite and quartz (Fig. c), which confirms that the elemental sulphur is formed during leaching. In Fig. d the TG-DTA curve of the leach residue are shown. On DTA curve on the temperature of 118 °C, the endothermic peak as a result of elemental sulfur melting is clearly visible. Then, in the range of 250-350 °C, weight loss as a consequence of the oxidation of sulfur to SO₂ gas occurs. The loss of mass due to combustion of sulfur on Fig. d is smaller than the sulfide sulfur which is oxidized during the leaching process, which indicates that the sulfur from sulfides is oxidised both to the sulfate and to the elemental form. The mass increase followed by exothermic effects in the range of 400-700 °C is a result of the oxidation of unleached sulphides in the solid residues. At temperatures above 720 °C weight loss occurs as a result of dissociation of sulphate and oxysulphates of lead, zinc, copper and iron with endothermic peaks on the DTA curve. XRD and DTA/TG studies have contributed in determining the mechanism of polymetallic concentrate leaching process in the system H₂SO₄-H₂O₂-H₂O:



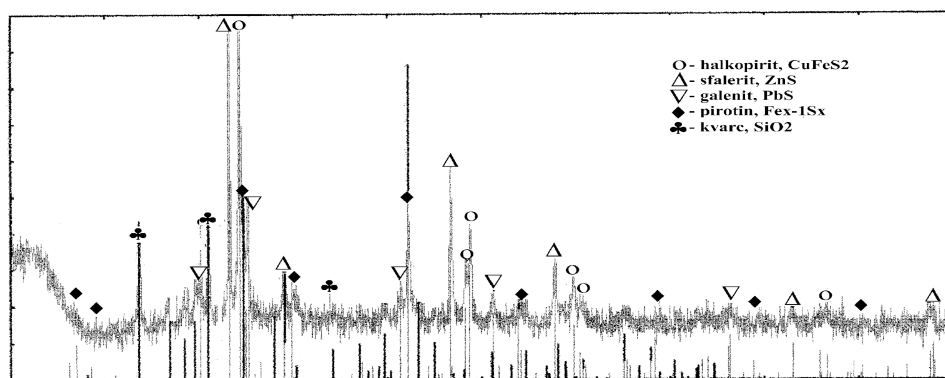
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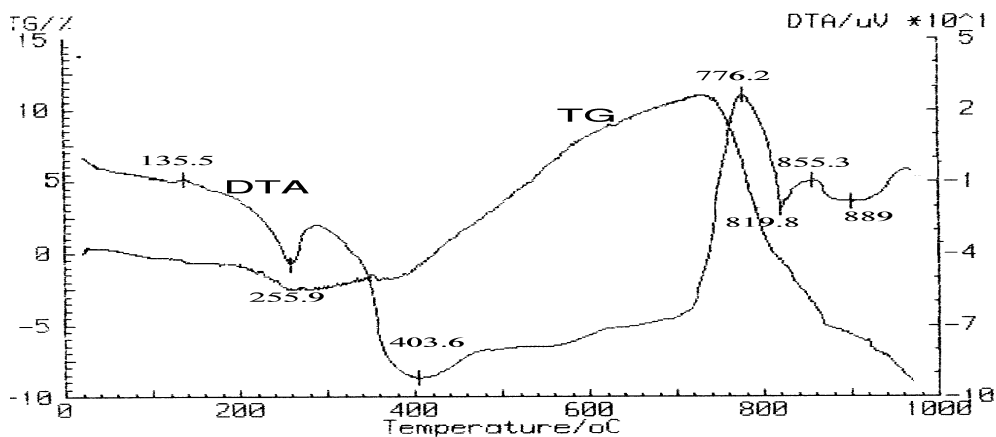
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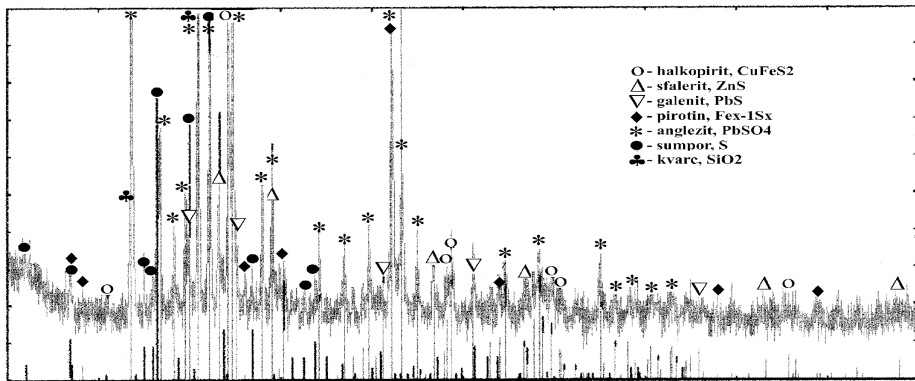
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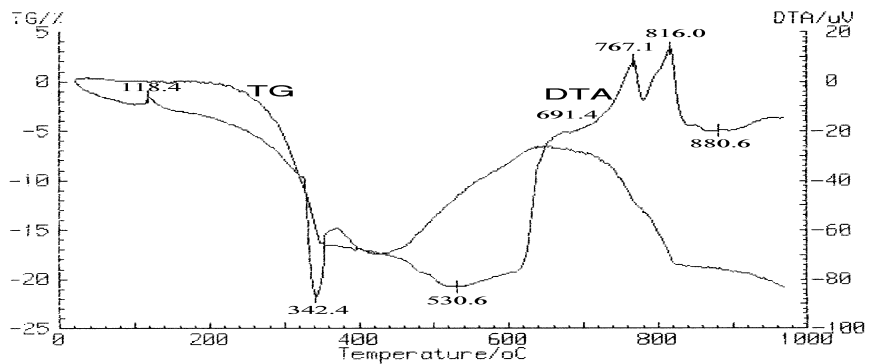
a)



b)



c)



d)

a) XRD analysis of the polymetallic concentrate; b) DTA/TG analysis of the polymetallic concentrate; c) XRD analysis of the leach residue: T=35°C, t=240 min; d) DTA/TG analysis of leach residue: T=35°C, t=240 min.



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