

3. Research Problem and Objectives

As stated in Chapter 2, the Great Dyke platinum reserve (in Zimbabwe) and the Platreef (in the Bushveld Complex in South Africa) have recently become major sources of platinum-group minerals (PGMs). These platinum reserves are altered, and difficult to process, requiring innovative beneficiation technologies to recover PGMs. As a result of weathering these ores contain high levels of talc (typical levels above 10% for the Great Dyke compared to less than 1% for the Merensky reef) and serpentine (typical levels of 60% for the Platreef). High reagent consumption and lower recoveries – compared with ores from the Merensky and UG-2 reefs – result. In addition, the Great Dyke and Platreef show poorer association of PGMs with base metal sulphides; larger portions of the PGMs belong to the Pd-Pt-Bi-Te, PGE-S-As and PGE-alloy classes (Van Wouw, 2003). Mineralogical investigations (QemSCAN) on all effluent flotation streams of Mimosa mine (located along the Great Dyke) indicated the presence of appreciable amounts of unrecovered platinum group minerals (PGMs) (Van Wouw, 2003). Most of the liberated PGMs found in the effluent streams belonged to the Pt-Pd-Bi-Te class. There are similar practical indications of poor recovery of PGE-bismuth tellurides from the Platreef (Dippenaar, 2002).

The idea which was tested in the experimental work was that poor recovery of liberated PGE bismuthotellurides could be caused by surface chemical effects (lack of interaction with the collector), or physical effects (lack of collision with or attachment to bubbles, or poor stability of attachment). The experimental work hence had the following specific aims:

- To determine the electrochemical interaction of ethyl xanthate with synthetic Pd-Bi-Te and PtAs₂ minerals, with impedance measurements, and voltammetry.
- To identify species on the surface by employing *in situ* Raman spectroscopy.
- To determine the potential dependence of the hydrophobicity of the mineral surface with electrochemically controlled contact angle measurements.
- To compare the collector interaction results of PtAs₂ (typical fast floater and very abundant in platinum ores) with that of Pd-Bi-Te.

- To quantify the actual flotation rate of synthetic Pd-Bi-Te by performing microflotation tests.
- To predict the possible effect of particle size on the flotation rate constant of Pd-Bi-Te.