Original device for the deoxidation of $CaO\text{-}CaCl_2$ melts

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Calcium chloride is a useful solvent for metallic oxide calciothermic reduction because of the high rate dissolution of its corresponding oxide CaO (about 20 mol. % at 850°C). As a consequence when reaction 1 is finished, the by-product CaO is dissolved in the media so that electrochemical operations can be achieved.

$$MeO_2 + 2Ca \rightarrow 2CaO + Me \qquad (1)$$

As no anodic chlorine gas is acceptable, studies are being made on anodic selective membranes [1]. Yttria stabilized zirconia (YSZ) is an attractive material for this aim even if its poor thermal shock resistance is a big disadvantage. We have already shown that $CaO\text{-}CaCl_2$ electrolysis with such a platinized zirconia membrane is possible [2]. However many problems have been raised, for one thing the too high anodic potential.

A new device has been tested in order to allow an easier platinum plating of the active area (Fig 1) The main advantages are: (i) an easier platinum plating, (ii) a better-defined active area and so a better-known current density, (iii) bottom corners do not belong anymore to this active area and (iv) if the membrane is damaged then the anodic active area is easier to be studied. Stationary polarization curves have been recorded (example on Fig. 2) so that we can say that significant current density can be reached without applying a too high potential.

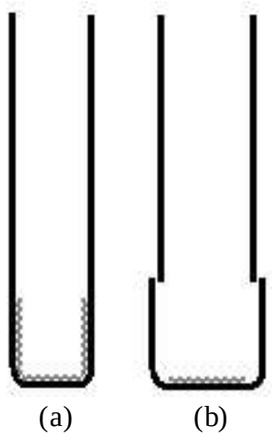

Figure 1: Scheme of the old (a) and the new (b) devices; the new one is made of a little crucible sealed with a tube

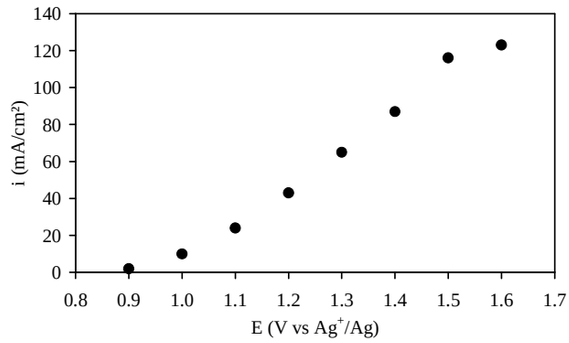

Figure 2: Polarization curve; 840°C; 12 mol % of oxide ions

References:

1. U.B. Pal, D.E. Woolley, and G.B. Kenney, "Emerging SOM technology for the green synthesis of metals from oxides," *JOM*, 53 (10) (2001), pp. 32–35.
2. A. Martin, D. Lambertin, J.-C. Poignet, M. Allibert, G. Bourges, L. Pescayre, and J. Fouletier, "The electrochemical deoxidation of metal oxides by calcium using a solid oxide membrane", *JOM* October 2003, pp. 52-54.