

Effect of Static and Dynamic Experimental Conditions on the Dissolution Behavior of Alumina in BOF Slags

Gaurav TRIPATHI , Annelies MALFLIET, Bart BLANPAIN and Muxing GUO

Department of Materials Engineering, KU Leuven, 3001 Heverlee, Belgium

Introduction

The recycling and valorization of Basic Oxygen Furnace (BOF) slag is important:

- Hot stage engineering of BOF slag: From low value waste to a high value added product
- Fast dissolution of additives is desired for smooth operation of hot stage slag engineering
- Fast dissolution gives sufficient time for modifiers to react with other components like free lime or magnesia to form more stable phases^[1,2]
- Dissolution of additives in BOF slag must be understood in both thermodynamic and kinetic aspects

Experimental

Dissolution of Al_2O_3 in industrial high basicity BOF slag (Table 1):

- Milled slag in Mo crucible, heated under inert atmosphere
- Al_2O_3 spheres were added to the slag at high temperature (Fig.1)
- Stirring with Mo rod, water quenching
- Compositional EPMA WDS analysis

Table 1. Composition (Wt. %) of the industrial BOF slag

Slag	CaO	FeO	Fe_2O_3	Al_2O_3	SiO_2	MgO	MnO	Basicity
Industrial BOF	42-55	14-20	5-10	0-3	9-15	0-5	0-8	3.5-5.0

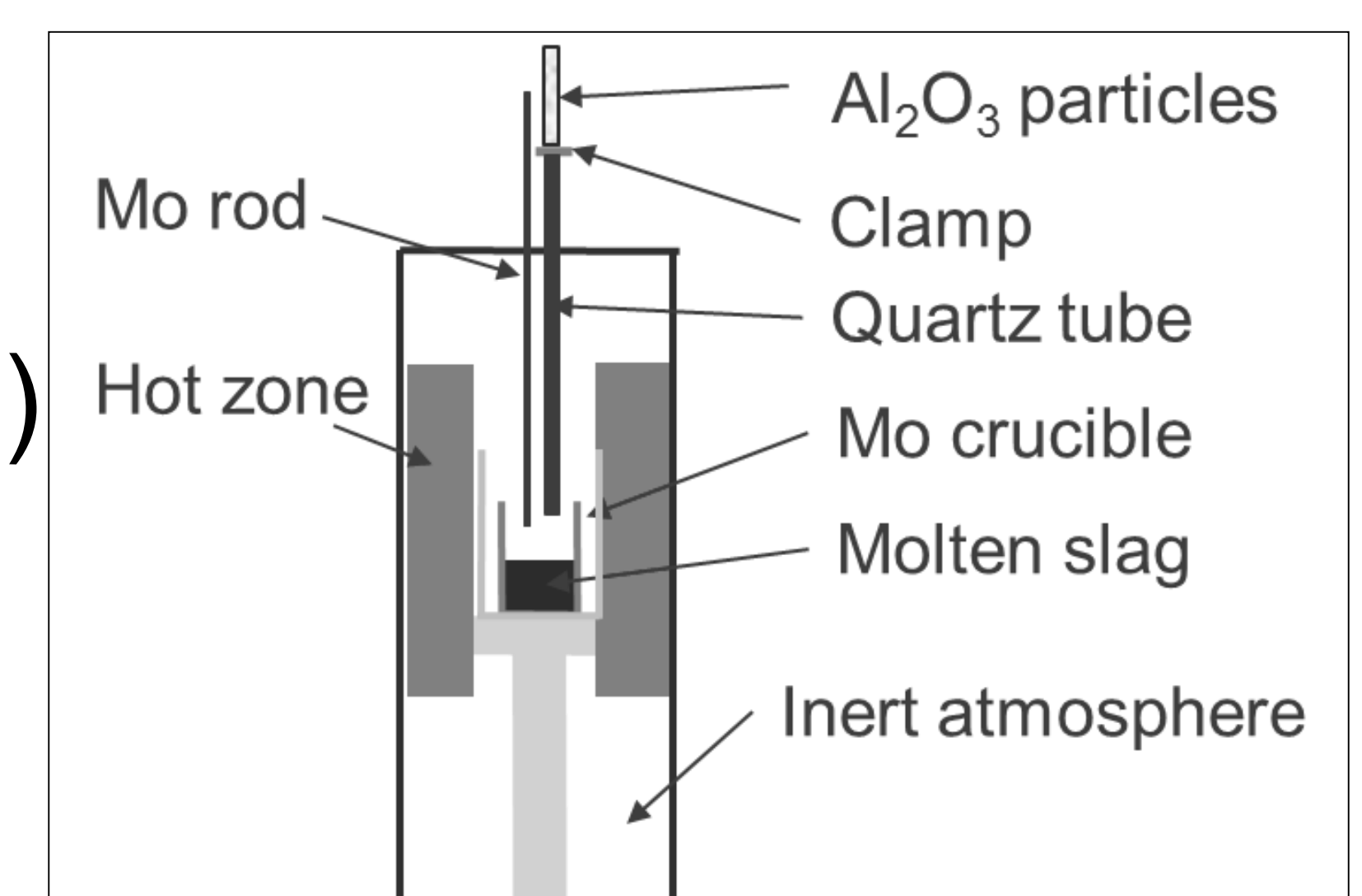


Fig. 1 Setup for the addition of particles to molten slag at high temperature

Results and Discussion

Indirect dissolution of Al_2O_3 particles

- The reaction product formed at Al_2O_3 /slag interface is CaAl_4O_7
- Reaction products in turn get dissolved in the molten slag
- At 1600 °C, there is a slight increase in the Al_2O_3 content in the slag
- No effect of stirring on the formation of reaction products at 1600 °C (Fig. 3(a,b))
- At 1500 °C, the formation of reaction products at the Al_2O_3 /slag interface seems inhibited under stirring (Fig. 3(c,d))

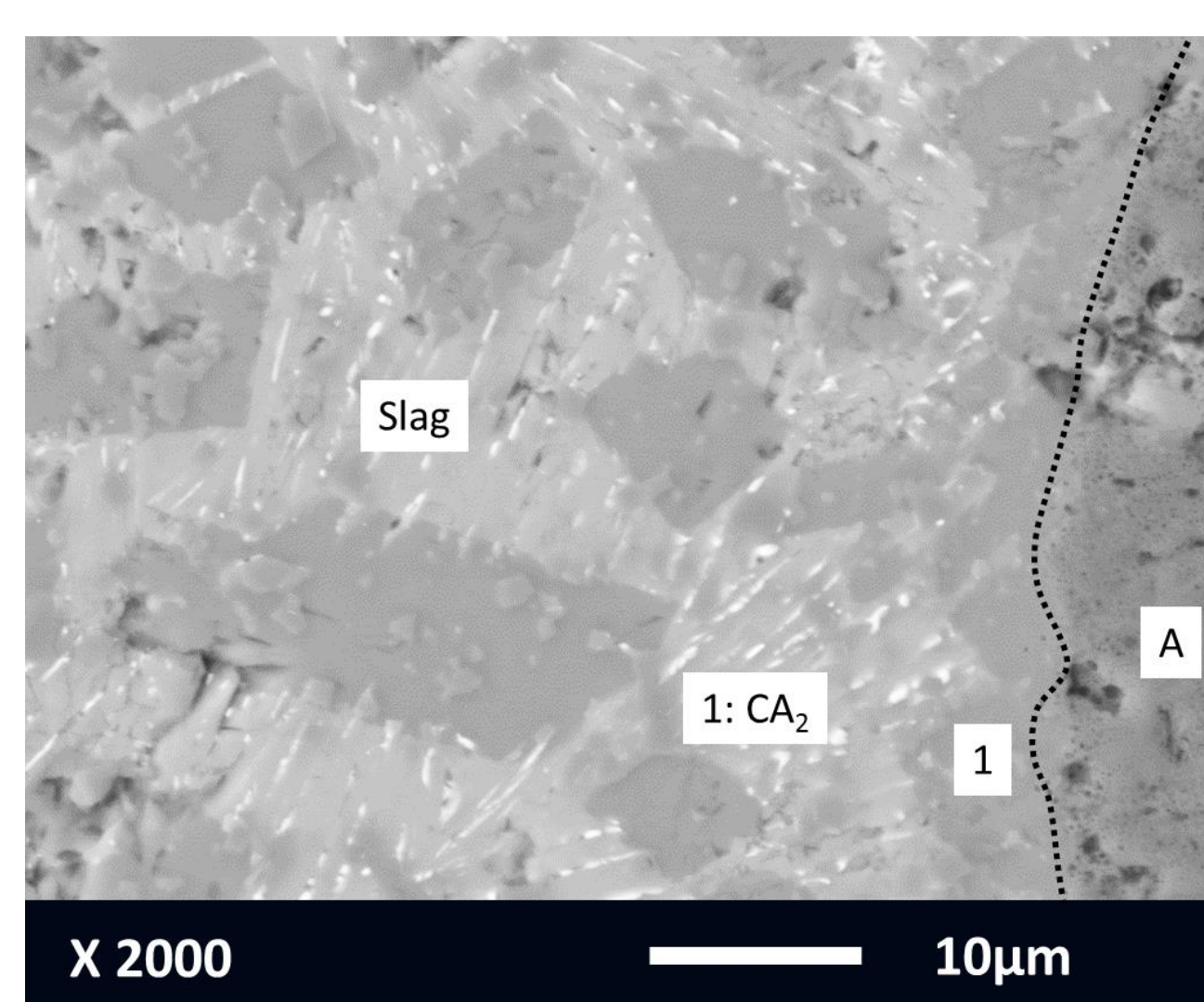


Fig. 2 Reaction products formed at the slag/ Al_2O_3 interface

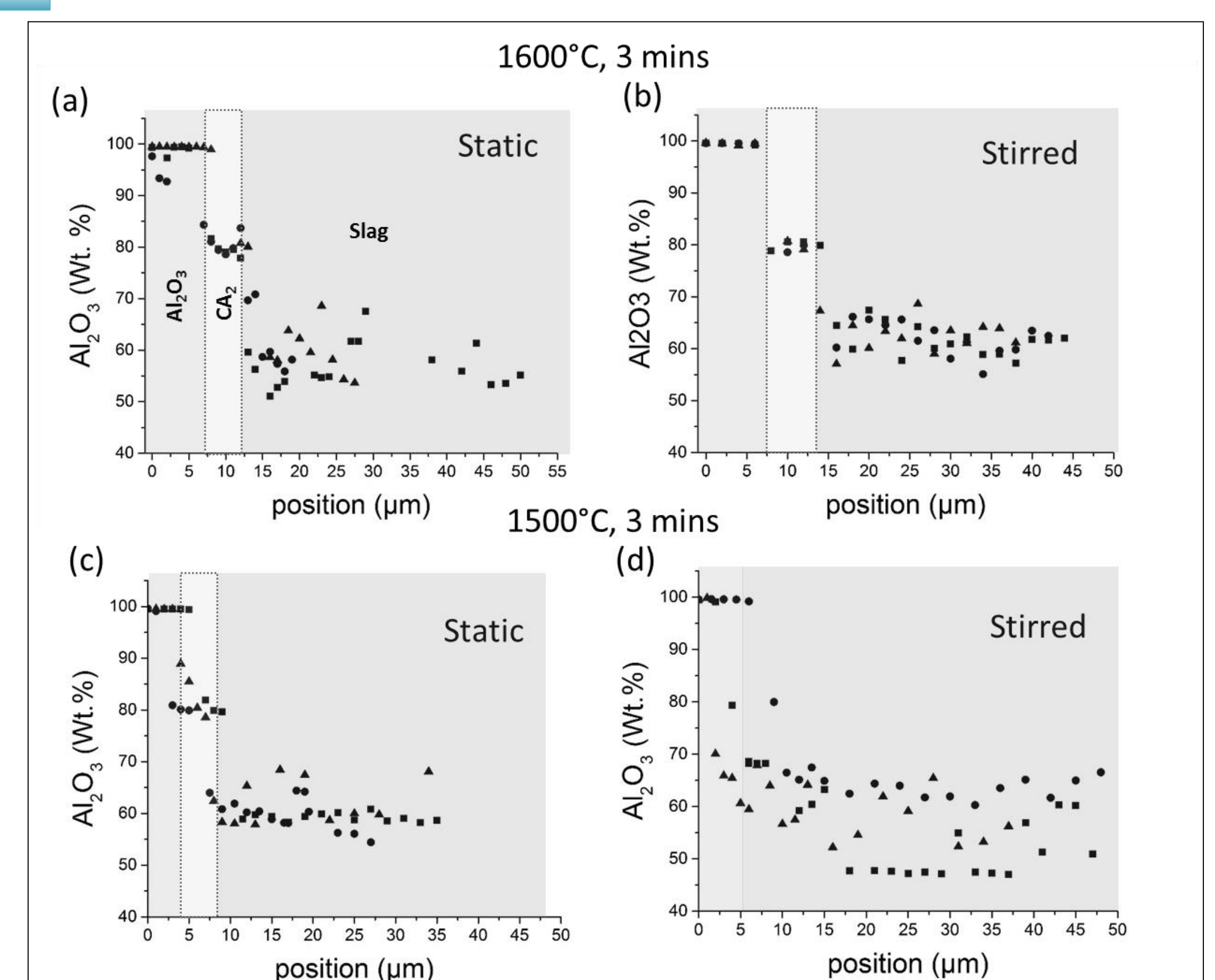


Fig. 3 Concentration Al_2O_3 from the particle towards the slag is shown for the samples at 1600 and 1500 °C

Conclusions

- The dissolution of Al_2O_3 in molten BOF slag is an indirect dissolution process
- The effect of stirring is temperature dependent and it can inhibit the formation of reaction products on the Al_2O_3 /slag interface