ANALYSIS OF SLAG FOAMING DURING THE OPERATION OF AN INDUSTRIAL CONVERTER

C. CICUTTI†, M. VALDEZ†, T. PÉREZ†, R. DONAYO‡, J. PETRONI‡

† Centro de Investigación Industrial, FUDETEC, J. Simini 250 (2804) Campana, Argentina
sidcci@siderca.com
‡ Gerencia de Áreas Primarias, SIDERAR, CC 801 (2900) San Nicolás, Argentina

Abstract — In the converter operation, a proper control of the slag-metal reactions that take place along the process is required to guarantee successful results. During the decarburization reaction a high gas flow rate is generated which increases the slag volume and can, eventually, promote its spill out of the converter. In this work, samples of slag and metal were taken out of an industrial converter at different stages of the process using a special device. The evolution of slag weight and composition was determined. Furthermore, calculations were performed in order to estimate the foaming capacity of the slags at the different stages of the process. It was found that the foam height reaches a maximum in the first half of the process, mainly due to the higher slag viscosity.

Keywords — Steelmaking, Converter, Slags, Foaming.

I. INTRODUCTION

Despite of the progress that Electric Arc Furnace technology has evidenced over the last years, Oxygen Steelmaking is still used to produce more than 50% of the total crude steel all around the world (Faure, 1993). In this process, the oxygen blown is mostly combined with the elements dissolved in the melt. Some of these elements (like Mn, Si and P) are oxidised and incorporated into the slag (Turkdogan, 1996; Deo and Boom, 1993). In the case of carbon, the reaction promotes large amounts of CO and CO2 that have to be evacuated through the slag layer. If the gas bubbles remain in the slag for a long time its volume increases and can be partly spilt out of the converter. Therefore, a proper control of the slag-metal reactions that take place along the process is required to guarantee successful results.

Although the foaming capacity of the slags has been determined in different laboratory studies (Ito and Fruehan, 1988a, b; Utigard and Zamalloa, 1993; Ghag et al., 1998; Wu et al., 1999), only a few attempts have been made to apply these results to industrial systems. Consequently, the aim of the present work was to estimate the foaming capacity of the slags during the operation of an industrial converter.

II. EXPERIMENTAL WORK

Trials were performed at Siderar steel plant (San Nicolás, Argentina) in a 200 ton industrial converter. It is an LD converter where inert gas is blown through the bottom (LBE system). A brief description of the process conditions employed during the trials and the different additions carried out along the blow are listed in Table 1.

Slag and metal samples were taken from the mouth of the converter at different times from the start of the blow. The sampling was carried out with the aid of a special device (van Horn et al., 1976) which enables the obtaining of slag and metal samples all at once, see Fig. 1. Only one sample was taken in each heat by interrupting the blow and dipping the sampler into the converter. Further details of the sampling procedure and the methods employed to analyse the metal and slag samples have been presented elsewhere (Cicutti et al., 1999; Cicutti et al., 2000).

Fig. 1. Sampling device employed during the trials.