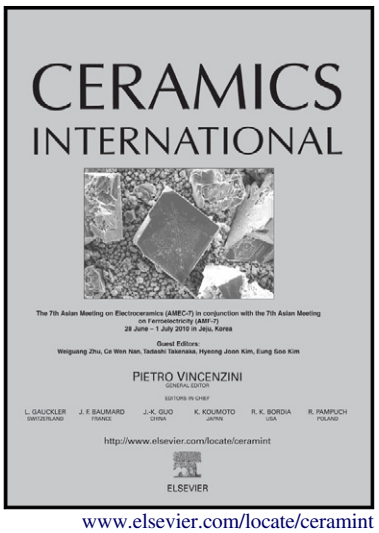

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Catalytic formation of one-dimensional nanocarbon and MgO whiskers in low carbon MgO–C refractories

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Abstract: Low carbon MgO–C refractories added with a Ni-containing catalytic precursor and Al were prepared. MgO–NiO composite powder was firstly prepared by mixing magnesia powder in nickel nitrate ethanol solution and then incorporated into MgO–C refractories after pre-treating. The phase composition, microstructure and mechanical properties of MgO–C refractories treated at 1000°C and 1400°C were investigated by means of X-ray diffraction, scanning electron microscopy coupled with energy dispersive X-ray spectroscopy and three-point bending test. The results showed that the addition of the Ni-containing catalytic precursor promoted the formation of one-dimensional nanocarbon at 1000°C and the growth of MgO whiskers at 1400°C, respectively. The in situ formation of MgO whiskers enhanced the mechanical properties of MgO–C refractories after coking at 1400°C, which showed higher cold modulus of rupture and much larger displacement than MgO–C refractories without addition of the Ni-containing catalytic precursor.

Keywords: One-dimensional nanocarbon; MgO whiskers; Catalytic precursor; MgO–C refractories

1. Introduction

MgO–C refractories have been widely used as the linings of converters, electric arc furnaces, steel ladles and RH vacuum degassers owing to their excellent corrosion resistance and thermal shock resistance [1–3]. Usually, such refractories contain high carbon content (12–18 wt %), which imparts some disadvantages, such as inferior oxidation resistance, high carbon pick-up in molten steel, higher heat loss and emission of more amount of CO_x [4,5]. With the development of advanced