2:40 PM

(PACC-S6-004-2022) The use of steelmaking slag as protection for oxidation of MgO-C refractories

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MgO-C is one of the most important refractories for steelmaking ladles. Carbon is a keycomponent which allows the refractory to have high resistance to thermal shock and to slag attack. However, Coxidizes in air; this risk is currently found during the pre-heating of the ladle (at the beginning and betweenproduction cycles). During the operation, the liquid steel is evacuated through ladle bottom leaving a slag layer adhered to theworking lining which serves as protection against oxidation of refractories' carbon. Nevertheless, this layercould suffer degradation by ambient humidity which affects its role as an oxygen diffusion barrier. This work analyzes how the refractory composition (graphite content, type of binder) and the slag degradationaffect the oxidation resistance of MgO-C materials. For testing, a slag layer was generated over one of theplane surface of the refractory cylinder (25x25 mm) by treatment at 1400°C (graphite bed). Only this face wasexposed to air (unidirectional test) at 1000°C (2 h). Variations in weight, depth of decarburized layer andgraphite content were used as oxidation indicators. To evaluate the effect of slag weathering, tests werecarried out after 2 and 10 weeks from the sample conditioning.

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(PACC-S6-005-2022) Structural evolution of a Al_2O_3-MgO×Al_2O_3 castable in the range 1000-1600°C

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Thermal and structural characteristics of an alumina-spinel castable (containing 2.5 wt.% CaO) was studied. The specimens were cast (8.0 wt.% water), cured in air at ambient temperature (48 h), then dried at 100°C (24 h) and prefiring at 500°C (3 h). Thermal behavior was analyzed by dilatometries at constant heating rate (5°C/min) up to 1600°C, and at constant temperature (range: 1000-1500°C). Crystallographic phases were determined by XRD and micro-structures were analyzed by SEM/EDS. Specimens heat treated at 1000°C and 1200°C showed Al_2O_3 (A) and $MgAl_2O_4$ (MA) as main phases. Between 1200-1300°C, the $2Al_2O_3$×CaO (CA_2) formation is promoted. Calcium hexaluminate $6Al_2O_3$×CaO (CA_6) is detected from 1400°C. The presence of CA_6 increases at 1500°C and 1600°C. From dilatometric curve, in the range 1000-1600°C, expansion and shrinkage alternative zones were observed. This behavior is associated to (i) the CA_2 and CA_6 formation, and (ii) the sintering/densification of ceramic grains with probable liquid assistance. Thus, considering the temperature profile, generated in service, through this material, both the formation of CA_2 and CA_6 and the sintering evolution during the first hours, lead to volumetric contractions and expansions in different zones. These volumetric changes generate mechanical stresses that can cause faults in the material.

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(PACC-S6-006-2022) Thermochemical Stability of Refractories in Hydrogen Atmosphere

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Direct reduction (DR) of iron oxide by hydrogen and use of alternative fuels such as natural gas and hydrogen in furnace have the potential to significantly decrease greenhouse gas emission in steelmaking while remain energy-efficient and economically competitive. However, the thermochemical stability of the refractories in the furnace linings in hydrogen atmosphere is not well known. Also, the effect of H_2O, formed during the DR, on the stability of the refractories is not known. This study focuses on predicting the thermochemical stability of magnesia, spinel, chrome, and alumina and aluminosilicate refractories in H_2 atmosphere (with/without H_2O) based on minimization of Gibbs free energy of reactions approach.

PACC7: Science and Technology of Glasses, Glass Ceramics, and Optical Materials

Glasses, Glass-ceramics, and Optical Materials

Room: Venetian (Level B)

1:30 PM - ***WITHDRAWN***

(PACC-S7-001-2022) Controlled Precipitation of Cesium Lead Halide Perovskite Nanocrystals in glasses and their Applications (Invited)

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Cesium lead halide perovskite nanocrystals have intriguing opto-electronic properties, and have promising applications in energy harvesting, information display and storage, etc. Glasses are chemically and thermally stable materials, and can serve as good host matrix for the cesium lead halide perovskite nanocrystals. Incorporation of cesium lead halide perovskite nanocrystals into glasses can significantly improve their stability and extend their applications. This work summarize the recent progress on cesium lead halide perovskite nanocrystals embedded glasses, including controlled precipitation of these nanocrystals through thermal treatment, ion-exchange, and femtosecond laser irradiation. These controlled precipitation make it possible to achieve high photoluminescence quantum yields, tunable composition and photoluminescence spectral range, spatially controlled distribution in glasses. Potential applications of these cesium lead halide perovskite nanocrystals embedded glasses as light-emitting diodes, micro-LEDs, and solar concentrators will be demonstrated.

2:00 PM

(PACC-S7-002-2022) Practical steps toward low-CO_2 environment

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During last decades low-CO_2 environment has become number 1 priority, which unites governments, manufacturers, scientists, and public organizations globally. Serious actions in the direction of low-emission world may save human civilization. Lets consider some examples, showing how selected R&D organization in close cooperation with industrial partners can promote low-emission material manufacturing, energy-saving applications, and, ultimately, alternative energy production. Material for wind-blade manufacturing. This particular development united several goals related to low-CO_2 initiative. First, W fiber glass developed by L.G.P. for and in close cooperation with 3B Fibreglass Company (Battice, Belgium) with wind blades production as the major application. Second, W-glass melting consumes much less energy per ton vs. such glasses as S-2 fiber glass that improves situation with CO_2 emission. Third, W-glass is cost effective material allowing to invest more resources in low-carbon initiatives. Low-Dk/Df L-glass developed by L.G.P. for AGY (Aiken, SC, USA) allowed making ultra-high frequency units, which made it easy to introduce 5G networks, and promoted faster development of many other energy-efficient communication technologies. Low melting, forming, annealing/tempering energy glasses