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ABSTRACT BOOK

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Introduction

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Refer to the Table of Contents to determine page numbers on which specific session abstracts begin. At the beginning of each session are headings that list session title, location and session chair. Starting times for presentations and paper numbers precede each paper title. The Author Index lists each author and the page number on which their abstract can be found.

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conditions, were investigated to produce mechanically stable alumina monoliths with 65 and 80 vol% porosity. The electron microscopy investigation of the pre-sintered alumina monoliths revealed that the size distribution and the shape of the pores could be tailored by controlling the particle size distribution and the shape of the wet pre-expanded microspheres. Highly porous and mechanically stable alumina foams achieved compressive strengths from 3 - 40 MPa. Given the relatively open pore structure, the pore size distribution, the pre-sintered mechanical strength, and the high porosity achieved, the produced alumina foams could potentially be used as support structures for separation, catalytic, and filtration applications. Moreover, the analysis of evolved gases showed the polymer microsphers released nitric oxides (NOx), sulfur compounds and COx components while the cellulose microspheres released COx and CH_4 gases suggest a reduction in the evolved harmful components and their low CO_2 impact.

(ICACC-P082-2024) Zirconia-yttria/lithium-sodium-potassium carbonates ceramic membranes with sodium-potassium carbonate anti-fouling layer for carbon dioxide permeation

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The interfaces of porous ZrO_2:3 mol% Y_2O_3 (3YSZ), prepared by thermally removing graphite during sintering, were modified by introducing a layer of $(Na,K)_2CO_3$ (NKC) before molten $(Li,Na,K)_2CO_3$ (LNKC) was impregnated into the pellet pores. X-ray diffraction (XRD), scanning electron microscopy (SEM-EDX), and electrochemical impedance spectroscopy (EIS) were the techniques applied to analyze structural phases, pore content, and carbon dioxide ion conductivity, respectively. EDX analyzes showed that LNKC face-to-face percolation was completed. EIS experiments were conducted at temperatures both below and above the melting point of LNKC for assessing the improvement of carbon dioxide permeation with the introduction of the NKC protective layer, apparently preventing partially 3YSZ-LNKC fouling reaction.

(ICACC-P083-2024) Application and characterization of a kerosine-fuelled High Velocity Oxy-Fuel (HVOF) Ti_2AlC coating on thermally stable P91 steel

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A class of ternary layered carbides and nitrides, known as MAX phases, combines some of the best properties of two distinct classes of materials: metals and ceramics. Specifically, MAX phases are stable at high temperatures, resist thermal shock, and some even form stable and protective oxide layers in oxidizing environments. Thus, they are excellent candidates for protective coatings in high-temperature applications. In this context, our focus is on using kerosene-fueled High-Velocity Oxy-Fuel spraying to deposit MAX phases onto P91 steel substrates for use as thermal barrier coatings. The chosen MAX phase for this study is Ti_2AlC, which offers an outstanding oxidation resistance. Our results indicate that during the spraying procedure, a portion of the MAX phase decomposes, another portion oxidizes, yet more than half maintains the initial and desired stoichiometry. Nevertheless, the resulting coating establishes a stable and robust bond with the steel substrate. In this presentation, we will discuss the detailed analysis concerning the relationship between the process, structure, and performance of the Ti_2AlC coating on the P91 steel substrate.

(ICACC-P084-2024) Continuous fiber-reinforced MAX-Phases: Investigation of a Pressure Slip Casting Route for the Production of $Al_2O_{3(f)}/Ti_2AlC$-CMCs

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MAX phase ceramics show great potential for a new, innovative generation of engineering materials for energy technology due to their excellent mechanical properties in a high-temperature atmosphere. Fiber-reinforcement of MAX phases show great potential to further increase the materials engineering capabilities. However, the mechanisms to introduce continuous fiber-reinforcement into the novel ceramic system are not understood yet. Suitable processes for the production of continuous fiber-reinforced ceramics are currently formulated only by colloidal manufacturing processes. A major challenge of colloidal processes regards the homogeneous impregnation of textile reinforcement structures. However, the formulation of highly filled, fiber-reinforced green bodies decreases with increasing complexity of the molded part design. For this purpose, the production of $Al_2O_{3(f)}$-Ti_2AlC-CMC is investigated for the pressure slip casting technology. The innovative composite material is being developed within the publicly funded project ContiMAX (German Research Foundation DFG project No.: 508093957). To this end, the research to be presented is investigating basic mechanisms of MAX phase CMC processing to contribute to the development of future sustainable material systems to replace a large number of metallic high-temperature elements and wear-intensive components.

(ICACC-P085-2024) MXene Derived Carbides As Precursors For Ultra High Temperature Ceramics

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$Ti_3C_2T_x$ MXene is a two-dimensional (2D) refractory carbide which has high solution processability, high aspect ratios, and exhibits one of the highest stiffness (~330 GPa) among solution-processable 2D materials. We have investigated a one-pot, surfactant-free, aqueous mixing method to develop homogeneous ZrB_2-Ti_3C_2 MXene green bodies. We present the phase transformation of Ti_3C_2 MXene to TiC_y at the grain boundaries upon sintering, role of cationic species on texturing, the interface interactions between the ZrB_2-TiC_y grains and their densification mechanisms. A nominal relative density of ~96% is achieved when 0.5 wt.% Ti_3C_2 MXene is added to ZrB_2 and spark plasma sintered at 1900C with 50 MPa pressure in inert atmospheres. The microstructure evolution, stability, and their effect on micromechanical properties of the resulting UHTCs will be presented and discussed. This study lays the groundwork for 2D MXenes to be used as template precursors for 2D carbides and their implementation as compatible materials for high-temperature applications.

(ICACC-P086-2024) Thermodynamically Consistent Model of Electrocaloric Effect

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The electrocaloric effect (EE) is a phenomenon in which a material shows a reversible temperature change under an applied electric field. Current state-of-art is presented briefly summarized in the WIKI paper "Electrocaloric effect": "The underlying mechanism of the EE effect is not fully established; in particular, different textbooks give conflicting explanations". One of the main difficulties

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