

show a promising enhancement in hardness and fracture toughness of the plasma-sprayed coating attributed to the existence of strong metallurgical bonding between metal ceramic particles and CNTs. In addition, CNT tentacles have imparted multi-directional reinforcement in securing the splats. High-resolution transmission electron microscopy shows interfacial fusion between metal-ceramic and CNT. Various strengthening mechanisms are discussed. A few examples of ceramic-metal-GO composites are also presented.

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(ICACC-HON-057-2018) Interfacial Issues in Brazing of Advanced Ceramics for Structural and Multifunctional Applications (Invited)

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Advanced ceramics are brazed using metallic interlayers for a variety of applications including heat exchangers, fuel cells, thermoelectric systems, and advanced sensors. High-temperature wetting of ceramics and the resulting interface formation govern the bonding in brazed assemblies in such applications. Investigations of the classical wetting behavior and interface characterization thus assume central importance in context of brazing. In this presentation, some results from high-temperature wettability studies using specially developed sessile drop and capillary purification test procedures (e.g., in-situ interface opening by droplet pushing) will be presented. In particular, the effect of oxide layer, ceramic dissolution and roughening, recrystallization and surface modification ahead of the wetting front, and capillary infiltration of substrate porosity will be discussed with reference to the brazing of oxide, carbide and nitride ceramics. High-temperature contact angle measurements on pure metals and alloys containing active elements in contact with ceramics will be presented together with the observations on interface characterization using OM, SEM, EDS and TEM. Implications of lab-based wettability test outcomes to industrial brazing of ceramics will be highlighted.

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(ICACC-HON-058-2018) Research on joining at Politecnico di Torino: Everything started more than 20 years ago (Invited)

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Origin, results and perspectives of 20+ years of research activity on joining at Politecnico di Torino, Italy, will be summarized and discussed. This talk will give an overview on our joining materials and techniques, on components we obtained by joining similar and dissimilar materials, our attempts to develop a reliable shear strength tests for joined materials, our industrial collaborations and international links, together with some news on our recently funded Centre on Advanced Joining Technology (J-TECH@POLITO).

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(ICACC-HON-059-2018) Non-conventional joining of a ceramic solid oxide fuel cell to a metallic interconnect (Invited)

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Co-generation of energy (heat and electric power) with ceramic solid oxide fuel cells requires consolidation of anode-electrolyte-cathode single cells with a dense electrolyte and porous anode and cathode. The consolidation is usually achieved by sintering the three-layer single cells according to special procedures to produce flat square shape cells. Non-conventional consolidation of several ceramic materials used in energy-conversion devices has been done

with success in several ceramic materials by electric field-assisted pressureless sintering, producing porous or dense components. The same approach has been tried in a flat single solid oxide fuel cell with yttria-stabilized zirconia solid electrolyte, lanthanum strontium manganite cathode and yttria-stabilized zirconia/nickel oxide anode with promising results, opening new routes for future low cost production of these devices. There is still a challenge in using that technique for joining ceramic single cells to metallic interconnector, one of the research areas of Dr. Mrityunjay Singh. Our efforts now are directed to carry out experiments aiming the joining of ceramic single cells to metallic interconnects by application of electric fields.

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(ICACC-HON-060-2018) Novel single crystals for electro-optical applications (Invited)

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Optical technology progress in a wide range of applications, and still demands the further development. Here, novel single crystals with advantageous characteristics will be introduced. $Tb_3(Sc_{1-x}Lu_x)_2Al_5O_{12}$ (TSLAG), CeF_3 and PrF_3 single crystals have been designed and grown for high-power laser machinery. They showed a higher visible-UV transparency and a larger Faraday rotation than $Tb_3Ga_5O_{12}$ (TGG). They are therefore very promising material in particular for new magneto-optical isolator applications in the UV-VIS-NIR wavelength. A new concept of high-brightness white LEDs based on Ce:YAG single crystal phosphors (SCPs), which can overcome the conventional temperature- and photo-degradation problems, is proposed. SCPs demonstrated excellent thermal stability with no temperature quenching, high values of luminous efficacy and increased quantum efficiency. Other single crystals investigated so far will also be introduced. Authors would like to thank to Tamura Corp., Koha Co., Ltd., Shinko Manufacturing Co., Ltd., and Fujikura Ltd., for the collaboration.

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(ICACC-HON-061-2018) Challenges and prospects for advanced laser ceramic processing

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Polycrystalline transparent ceramics are emerging as a highly promising alternative to single-crystal materials for potential utilization in a wide range of optics and photonics applications, most notably being ceramic lasers and scintillators. In active pursuit of successfully processing optical quality materials, crystallographic cubic ceramics have been studied, however, processing anisotropic transparent ceramics presents significant challenges due to their inherent birefringence. In attempt to process transparent non-cubic ceramics to achieve nanostructure grain size, a field-assisted sintering method is studied in which the ceramic samples can be quickly densified without significant grain growth. Meanwhile, laser ceramics could be made by dry and wet forming techniques. The gel-casting is a near-net shaping process for simple and complex shapes of ceramic fabrication using some of organic materials for the gelling reaction. The process has some disadvantages associated with toxicity, rigid conditions for reaction and high amount of organic addition. A newly developed gelling system without using toxic organic compounds has been investigated to develop transparent complex-shaped ceramics. This novel process is promising to fabricate large-size and complex-shaped transparent ceramics for optical and photonic applications.