The 4th International Conference on Material Strength and Applied Mechanics

MSAM 2021

CONFERENCE PROGRAM

August 16-19, 2021

Online - Microsoft Teams Meeting

China Standard Time (GMT+8)

*For MSAM2021 Academic Exchange Only

oxygen exchange at moderate-high temperatures on the presence of reducing/oxidizing agents or using different electrochemical configurations. This is possible by a combination of large oxide-ion conductivity in these structures, and a small free energy difference between (4+/3+) redox pairs of many 3*d* transition metal ions. Here we demonstrate the room temperature topotactic transformation between PV $SrFeO_{3-d}$ and BM $SrFeO_{2.5}$ induced either by the electric field of an Atomic Force Microscopy (AFM) tip or low dose focused ion radiation (FIB). Charged oxygen vacancies in the PV can be manipulated with nano size resolution, creating accumulation regions where they spontaneously rearrange to produce the BM phase. The stability provided by the change in the crystallographic transformation reduces the oxygen diffusion once the electric field and ion radiation are removed (high retention of on/off states). This allows the local control of the chemical, electrical and magnetic properties, with very high spatial resolution. Our results open the door to the fabrication of stable ionic-based devices which imply local crystallographic transformations.

MS1673
Contemporary Challenges of Mechanics of Materials and Structural Components

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Aim: To focus an attention on the selected contemporary approaches for investigations either materials or structural components with special emphasis on their joining.

Methods: Digital Image Correlation (DIC) technique, enabling analysis of deformation maps variations in materials containing artificial stress concentrators, was used to capture data representing their mechanical properties evolution up to the fracture.

A quality of the welded joints (made of High Strength Steel) was determined based on the results of fracture toughness and fatigue tests. Such experimental program enabled, respectively, an identification of the CTOD parameter for each zone of the welding joint and determination of the Wöhler diagram. The characteristic features of fracture regions from both types of mechanical tests were additionally captured using macro-photography.

Mutual reactions between the selected components of the Rear Underrun Protective Device (RUPD) under loading conditions were observed by means of DIC system (PONTOS 5M). It enables determination of vectors reflecting a deflection parameters of the components in the three-dimensional coordinate system (3D).

Results: In the case of tests carried out on specimens containing notches, the deformation field distributions and their mutual interactions until decohesion were determined. The differences in behaviour between material with and without notches were represented by a change in the yield stress values only.

The CTOD parameter values of the parent material, heat affected zone and weld were equal to 0.268

mm, 0.220 mm, 0.386 mm, respectively, thus indicating differences in the fracture toughness of the zones. The dominant feature of the parent material fracture can be characterised by the longitudinal cracks. In the case of HAZ, the number of longitudinal cracks was reduced due to welding, while in the weld zone such form of defects entirely vanished.

The results of the fatigue tests showed a high sensitivity of the weld to the cyclic loading. It is well reflected by the line of limited fatigue strength within the stress range from 650 MPa to 125 MPa, and moreover, for the relatively low value of the fatigue limit (100 MPa).

The results of the stand tests showed significant differences in the RUPD behaviour depending on the area position tested. Thanks to them, an occurrence of the plateau effect in the force course was easily identified.

Conclusions: Database for the material and components subjected to loading can be efficiently captured using DIC method.

Thanks to the selected features of DIC, such as the possibility of using different sizes of the measuring points for example, it can be used in the study of components of various shapes and dimensions.

Application of the welding joints between components built with the use of modern materials into engineering practice should be decided on the basis of comprehensive mechanical tests, definitely including tests for the fatigue life and fracture toughness determination.

MS1604
Joining of Alumina Ceramics by Conventional and Microwave Brazing

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Aims: The objective of the present study is to compare the performance of alumina-alumina joints fabricated by microwave-assisted brazing method with the similar joint formed by conventional brazing method.

Methods: Alumina was joined with alumina by microwave-assisted and conventional brazing methods using TICUSIL (68.8Ag–26.7Cu–4.5Ti in wt.%) as the brazing alloy at 910^{o}C-960^{o}C for 5-20 min.

Results: X-ray diffraction analysis showed that the Ti-based compounds were formed at the substrate-filler alloy interfaces of the brazed joint as reaction products. The cross-sectional microstructure of the brazed joint observed by scanning electron microscopy showed defect free interfaces. The energy dispersive X-ray analysis determined the elemental compositions at the selective points of the joint cross-section, which supported the X-ray diffraction results. The nanohardness and Young's modulus of the substrate-filler alloy interfaces showed no abrupt change, which suggests consistent joint performance in service. Brazing strength measurement and helium leak test provided the evidence for good alumina-alumina joint formation.