WEDNESDAY, June 22

8:30 a.m. - 10:00 a.m. Room A
SMS-III: SMART MATERIALS AND STRUCTURES, NDE

SMS-15: Self Repair of Matrices
C.M. DRY, Natural Process Design, E-mail: drycementmixer@aol.com

Self repair of matrices has received much attention. It is an enabling technology for both the ceramics and polymer industries. However each application must be tested and designed for each set of circumstances. This paper will discuss the various application under consideration and the main mechanical engineering issues involved. Applications include self repair of vehicles, infrastructure and consumer goods and the issues are survival under processing conditions, end use conditions and the efficiency of repair for the environmental insult which is to be repaired.

SMS-17: (Crack-healing + Proof Test): A New Methodology to Guarantee the Reliability of a Ceramics Component
M. ONO, W. NAKAO, K. TAKAHASHI, K. ANDO, Yokohama National University; M. NAKATANI, NHK SPRING Co., Ltd, E-mail: 003ga405@ynu.ac.jp

Combination of crack-healing and proof-test is proposed as a new methodology to guarantee the reliability of a ceramics component, because crack-healing and proof test are effective techniques to overcome surface cracks and embedded flaws, respectively. In this study, the effect of crack-healing on the Weibull distribution was investigated for alumina/SiC particle composite which has excellent crack-healing ability. Characteristic strength of the crack-healed specimens was increased 2.4 times that of as-cracked specimen. Moreover, the minimum guarantee fracture stress at high temperature for the specimens proof-tested at R.T. after crack-healing was estimated. The fractures stress of the proof-tested specimens at elevated temperature was also measured at elevated temperature. From this result, minimum fracture stress at high temperature was determined. Calculated minimum fracture stress agreed well with the values measured by experiments. Therefore, it is concluded that the combination of crack-healing and proof-test is the effective techniques to guarantee of the fracture stress at high temperature of the ceramics component.

SMS-18: [Crack-healing+Proof Test+In-Situ Crack-Healing]: A New Methodology to Guarantee the Structural Integrity of Ceramic Components
K. ANDO, K. TAKAHASHI, K. FURUSAWA, W. NAKAO, Yokohama National University, E-mail: andokoto@ynu.ac.jp

Recently, the authors developed Si3N4, Al2O3 and mullite ceramics with good self-crack-healing abilities. It was shown that the optimized crack-healing condition to get high temperature strength was: 1573K, 1 h, in air, and the healed zone exhibited the same strength as the base material. Using this good healing ability, a new methodology to guarantee the reliability of ceramic components "crack-healing + proof test" was proposed. However, if a crack initiated during service, reliability would be severely impaired. Therefore, if a material can crack-heal during service, and if the healed zone has enough strength at the temperature of healing, it would be very desirable for structural integrity. From the above points of view, a new methodology to guarantee the structural integrity of ceramic components using in-situ crack-healing ability was proposed and the usefulness was discussed using the test results in terms of crack-healing behavior and proof test theory by the authors.

SMS-20: Effect of Crack-healing Applied Stress on Fracture Strength and Threshold Stress during Crack-healing Treatment
W. NAKAO, K. TAKAHASHI, K. ANDO, Yokohama National University, E-mail: wnakao@ynu.ac.jp

Alumina/15 vol% SiC particles, alumina/20vol% SiC whiskers, mullite/15vol% SiC particles and mullite/15 vol% SiC whiskers composites having excellent crack-healing ability are subjected to crack-healing under elevated static and cyclic stresses at elevated temperatures from 1000 °C to 1200 °C. The bending strengths of the specimens crack-healed under stress are investigated at the crack-healing temperature. From the obtained results, the threshold stresses during crack-healing, which is upper limit stress been safely able to apply during crack-healing, are determined. It is found that crack-healing can eliminate the pre-crack under stress below 64 % fracture strength of the as-cracked specimens, if the ceramic components have an adequate crack-healing ability.

8:30 a.m. - 10:00 a.m. Room B
PLF-II: PLASTIC FORMING AND ADVANCED PRODUCTS

PLF-07: Metal Forming Analysis of the Muffler Tube in the Perforating Process
K.T. HAN, Pukyong National University, E-mail: kthan@pknu.ac.kr

Recently there has been a growing interest in the design and manufacturing of the muffler tube due to the strict environment regulations. A muffler is an important part used to reduce noise and to purify exhaust gas in cars and heavy equipment. The shape of the muffler tube and the number of the tube hole has been made variously according to the weight and function of the car. The perforating technique of the muffler tube has a great influence on the manufacturing cost. In this study, metal forming analysis has been carried out to investigate the perforating process for the muffler tube and predict an optimal forming conditions of the muffler tube. Also its simulation results by the finite element method were reflected to the die design and the manufacturing system for the muffler tube. The perforating process is performed in the longitudinal direction of the tube. According to the simulation results, when the shear angle of punch was similar to the tube curvature, the optimal shape was obtained. Also when the clearance of die was 0.2mm, the burr was minimized and optimal shear section was obtained.

PLF-08: Clarification of Twist Occurring in Curved Hat Channel Product of High Strength Steel Sheet
Y. HIROSE, M. ASAKAWA, H. UTUGI, H. KIMURA, Waseda University; Y. HUISHIRO, H. YANO, UNIPRES Corporation; I. HAYASHI, Waseda University, E-mail: hey-yu@moegi.waseda.jp

This paper deals with twist occurring in two kinds of hat-channel product made from high-strength steel sheet. The product consists of a curved portion and a straight portion in the longitudinal direction. One (2D) type has curvature on the horizontal plane, and the other (3D) type has additional curvature on the vertical plane. Twist in the longitudinal