probe and the treated material under the water-immersed environment. By keeping narrow gap between two substances, and by vibrating high frequency (2-30kHz) for one side of substance, the innumerable cloud-cavities have been generated and dissipated. The confined cloud-cavities interfere each other and create high pressure and high sonic wave region, which beat the treated material surface. Ferrous, stainless steel and aluminum material had been treated in this process. Material hardness is increased 30-50% compared to the virgin material. And the depth of hardness is over 100 micron. This process is extremely competitive to conventional shot blasting methods, which are dusty, and energy consumed process. Application of this process is useful for machinery parts (gear, cam shaft, sleeves valves and etc.). This process is also effective to the stress relief for welded part.

CSW-03: Improvement of Surface Layer Characteristics by Shot Lining
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The metal lining is available to improve surface properties of the products. For example, the lining of metal surface with dissimilar material such as stainless steel is useful in heightening the wear and corrosion properties. Although the sprayed metal coating is employed for the metal lining, bond strength is not high. On the other hand, clad metals are produced by rolling and extrusion. However, the cladding is not easy in the case of a large difference between flow stresses of the bonded metals.

In the present study, lining of the metal substrate with this foils using shot peening was investigated to improve the surface layer characteristics. In the shot peening experiment, the metal foils set on the metal substrate are pelted with hard particles traveling at a high velocity. The foils are bonded to the surface of the substrate due to plastic deformation induced by the collision of the particles. The foils and the substrate are heated to heighten the bondability because of the reduction of flow stress. Lining the substrate with the hard powder sandwiched between two aluminum foil sheets was also attempted. In this experiment, a centrifugal shot peening machine with an electrical heater was employed. The substrates are commercially aluminum alloys, magnesium alloys and titanium alloy, and the foils are commercially aluminum, titanium, nickel and copper. The effects of shot speed and the heating temperature on the bondability were examined. The wear resistance was also evaluated by grinding. The foils were successfully bonded to the metal surface. It was found that the present method was effective in improving of surface layer characteristics.

CSW-04: Surface Texturing of CoCr by Nd:YAG Laser
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Laser surface texturing (LST) is a common surface engineering approach used to improve tribological performance. LST has been used to provide engineered surfaces for a number of machine element applications such as bearings and seals, and for manufacturing processes such as drawing, forging and sheet metal forming. All of these applications are similar in that fairly constant forces and velocities are usually encountered. A more demanding problem, and one where engineered surfaces have not been as widely applied, is one where the force and/or the sliding velocity are not constant, such as in cylinder liners, cams, and articulating surfaces. For these conditions, it is desirable to produce dimples from laser texturing that are not in the usual hemispherical shape. This paper describes experiments and theoretical modeling for producing textures intended to be useful for both steady and unsteady machine design and manufacturing applications. The use of a Nd: YAG laser can produce either symmetric or asymmetric dimples on the surface, which were measured and correlated to process parameters. Based on model for symmetric dimples, dimple dimensions and profiles can be controlled by the laser operator. More work will be done to finish the model for asymmetric dimples.

CSW-05: Evaluation of Mechanical Properties and Microstructure in Ion-Irradiated Surface Layer
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Target vessel materials used in spallation neutron source will be exposed to proton and neuron irradiation and mercury immersion environments. In order to evaluate the surface degradation of the vessel candidate materials due to such environment, the triple-ion beam irradiation taking the spallation reaction into account and mercury immersion tests were carried out. Mechanical properties of the gradient surface layer were evaluated by the inverse analysis with multi-layer model that considers distribution of surface characteristic was applied to the load and depth curves measured by using the instrumented indentation machine. Transmission electron microscopic observations were performed to evaluate the changes of microstructure in irradiated surface layer using focused ion-beam cut micro-specimen. The mechanical properties distributions in the surface layer were evaluated quantitatively and the changes in microstructures were correspondent to the property distribution. It was confirmed that the ductility loss is enhanced by the irradiation and mercury immersion, and simulated stress and strain curves of the ion-irradiated surface layer were adequately in good agreement with the curves of experimental equivalent neutron-irradiated material.

8:30 a.m. - 10:00 a.m.  Room D
CMC-II: CERAMICS AND CERAMIC MATRIX COMPOSITES

CMC-09: Hybrid Bonding between C/C Composites Using Si Infiltration
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In real hot structures, formation of complicated shapes is often required; However it is in general not easy for C/Cs to form various shapes. In the present paper, a newly devised hybrid bonding method was proposed as a suitable bonding technique for C/Cs to fabricate such structures. This bonding is composed of carbon bonding infiltrated with Si melt into the bonding layer. The principal features of this bonding are to be formed without pressurization and to yield high strength. Optimum process conditions of the hybrid bonding were first explored. Then using the optimized bonding, the strength of the hybrid bonding using 20-C/Cs as substrates was evaluated up to temperatures of 2000 K. The strength of the hybrid bonding in-creased with rise in test temperature. This bonding strength enhancement at elevated temperatures was shown to be caused by crack-arresting effect by the presence of SiC within bonding layer and by the release of thermal mismatch stress between the bonding layer and substrate C/Cs.

CMC-10: Rotational Strength of C/SiC Composite Blisk Model
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The ceramic matrix composites (CMCs) are very hopeful for turbine materials of aircraft engines owing to both their high strength and high-