the damage formation. Additionally, droplet impact analyses were carried out to investigate the correlation between isolated pit profile and micro-jet velocity. We confirmed that the value of depth/radius was applicable to estimate micro-jet velocity, and the velocity at 560 W in MiMRT equivalent to 1MW proton beam injection was 300 m/s approximately

IMP-03: A New Method for Making Surface Composite Layer by Diamond Particles on an Aluminum Plate through Underwater Shock Compression
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A new method to make a composite layer reinforced by diamond particles on the surface of an industrial pure aluminum plate is proposed. By using an underwater shock wave derived from the detonation of an explosive, diamond powders (10-20 micrometers) were pressurized through other aluminum flyer plate driven by underwater shock wave, and the diamond powders were successfully accelerated and pushed into the aluminum substrate. The thickness of diamond rich layer was about a few hundreds micrometers from the surface and the content was decreased toward the bottom side. It is also pointed out that small amount of diamond powders are still confirmed near the bottom area at 1 mm in depth. The making of such reinforced surface layer is considered only available through an intensive deformation of aluminum by a hypervelocity collision of diamond particles.

IMP-04: A Method of Designing Uniformly Distributed Underwater Shock Pressure for Controlling the Condition of Explosive Welding of a Thin Plate - Effect of Inclined Angle of Explosive to Get Uniform Pressure Distribution
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A method of explosive welding using underwater shock wave has been proposed and some industrial possibilities have been suggested. The use of high explosive is obliged as to achieve a high enough velocity for getting strong bonding through surface deformation of both components to be welded, and the use of inclined set-up angle of the explosive is requested as to decrease the horizontal collision point velocity which is one of the important parameters to be satisfied. The inclined set up induces difference in the pressure applied to the flyer plate, which makes difference in the condition of acceleration with horizontal position as far as using a fixed-thickness explosive. This limits the size of the materials to be welded, therefore, it is waiting to develop a method to modify the pressurizing condition. The authors have proposed a method to increase the thickness of explosive linearly from detonator side toward the end side. The present investigation intends to clarify the effect if inclined angle of explosive based on numerical simulation using AUTODYN-2D.

IMP-05: Numerical Evaluation of Measurement Accuracy of Non-coaxial Hopkinson Bar Method
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The high measurement accuracy in dynamic material testing is required for designs and numerical simulations based on the accurate modeling of stress-strain relations at various strain-rates. The Hopkinson bar method (HBM) is the most widely used experimental technique for the dynamic compression test, but not used very much for the dynamic tension test. The non-coaxial Hopkinson bar method (NCHBM) is one of the recently proposed methods for dynamic tension testing and is based on HBM. In the most part of this study, the accuracy of the stress-strain relations obtained on the basis of NCHBM was investigated by using the FEM code LS-DYNA. The finite element models of NCHBM apparatus and plate type specimens of various dimensions were made in detail. The target material employed in this study was mainly the mild steel that was proper for the investigation of measurement accuracy. On the other hand, SUS316 stainless steel and A7075 aluminum alloy were also modeled as specimen materials for the comparison with the experiments. The effects of the bending, the constraint condition, the applied velocity (the rising time in particular), the size and geometry of specimen, and the strain rate were examined systematically. For an example configuration, especially, the relation between the gauge-length limit and the strain rate to give an adequate accuracy for dynamic stress-strain curves was obtained. Furthermore, the influence of the fixation of specimen was confirmed by way of experiment.

IMP-06: Microscopic Observation of the Side Surface of Dynamically-Tensile-Fractured 6061-T6 and 2219-T87 Aluminum Alloys with Pre-Fatigue
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After unexpected failure of metallic structure, microscopic investigation will be performed. Generally, such an investigation is limited to search striation pattern with a SEM (scanning electron microscope). But, when the cause of the failure was not severe repeated stress, this investigation is ineffective. In this paper, new microscopic observation technique is proposed to detect low cycle fatigue-impact tensile loading history. AI alloys, 6061-T6 and 2219-T87, were fractured in dynamic tension, after severe pre-fatigue. The side surface of the fractured specimens was observed with a SEM. Neighboring fractured surface, many opened cracks on the side surface have been generated. For each specimen, the number of the cracks was counted together with information of individual sizes and geometric features. For 6061-T6 Alloy specimen with the pre-fatigue, the number of the cracks is greater than that for the specimen without the pre-fatigue. For 2219-T87 alloy, the same tendency can be found after a certain screening of the crack counting. Therefore, the crack counting technique may be useful to detect the existence of the pre-fatigue from the dynamically fractured specimen surface.

IMP-07: Prediction of Mechanical Behaviour of Low Carbon Steel at High Strain-Rate Using Thermal Activation Theory and Static Data
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Thermal activation theory concerning the mechanical behaviour of various metals has been studied theoretically and experimentally by many researchers. Nowadays, it is well-known that the thermal activation theory is quit useful to explain the mechanical behaviour of various metals in the wide range of temperature and strain-rate. In this theory, true stress of metals is considered to consist of two parts, one is the thermal component of stress which depends on temperature and strain-rate, the other is the athermal component of stress which only depends on strain. Therefore, if these components are separated suitably and the behaviour of the effective stress is clarified at various temperature and strain rate, it can be expected that stress-strain curves under time-consuming testing conditions such as a high strain rate or a high temperature can be estimated from data given by relatively easy tests. Recently, an useful report titled "The final report of research group on high-speed deformation of steels for automotive use" was published, in which a lot of methodical experimental data of various steels and reviews about thermal activation theory are involved. In this study, a number of trials to obtain the lower yield stress or flow stress at high strain rates from quasi-static data were carried out using the data shown in the report. A relation between the
IMP-08: Effects of Bake Hardening Property on Dynamic Yield Strength of Ultra High Strength Sheet Steels
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The application of high strength steel for automotive body parts, especially pillars and cross members is one of the most effective methods both reducing the weight of automobiles and safety. Generally, the higher yield strength of steel sheets contributes to crash energy management. It is important to measure the dynamic yield strength correctly in order to evaluate the crash energy absorption property. However, it is difficult to measure the yield strength under dynamic loading condition. In this study, the tensile tests were carried out to determine the accurate yield strength on the ultra high strength steel sheets under dynamic loading condition. Four kinds of steel sheets with various strength levels are selected for this study. The dynamic tensile properties are measured with the split-Hopkinson bar apparatus at the strain rate of 1000 /s. Moreover, it is evaluated the effects of bake hardening (BH) treatment on the dynamic yield strength, because the influence of BH treatment on the yield strength has not been adequately clarified under dynamic loading condition. BH treatment is done in some samples at 443K x 1200sec. The effects of BH property on the strain rate dependence of the yield strength are discussed in the ultra high strength steel sheets.

Coffee Break

SMS-09: Thermomechanical Properties of Shape Memory Composites
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The shape-memory composite belt with a TiNi-SMA wire fiber and a polyurethane-SMP sheet matrix was fabricated. The bending actuation characteristics of the belt were investigated by the thermomechanical tests. The results obtained can be summarized as follows. (1) Residual deflection close to the maximum deflection is obtained by cooling under constant maximum deflection. The residual deflection disappears by heating under no load. Both the rate of shape fixity and the rate of shape recovery are close to 100%. (2) Recovery force appears by heating under constant residual deflection. The recovery force is 93-94% of the maximum force. The development of high functionality of shape-memory composite elements is expected by various combinations of SMAs and SMPs.

SMS-10: Fabrication, Characterization and Modeling of Porous NiTi Shape Memory Alloy
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Porous NiTi shape memory alloy with several porosities are processed by Spark Plasma Sintering (SPS) method. The compression behavior of the porous NiTi was examined with the aim of using it as a high energy absorbing material. Two models for the macroscopic compression behavior of the porous NiTi are proposed. The analytical results are compared with the experimental data for porous NiTi with 13% porosity, resulting in a reasonably good agreement.

SMS-12: Shape Morphing Truss Structure for Aerospace and Marine Applications
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One of the goals in shape morphing technology is to cause surfaces to displace even when resisted by large pressure loads (or heavy weights). The challenges become especially demanding when minimum weight requirements and power budgets are imposed. This challenge can be addressed by seeking structures that are simultaneously statically-determinate, yet stiff. Applications of such structures range from the aerospace and marine sectors to optical devices. Sensing and control circuitry facilitate a structure suitable for high-amplitude large-force vibration or displacement control. A concept for a high authority shape morphing plate design incorporates an active back-plane comprising a Kagome truss, capable of changing the shape of a solid face, connected to the back-plane by means of a tetrahedral truss core. The most important benefit of the Kagome based structure results from its ability to attain several target shapes equally well while using only one configuration of actuators. The design is performed by a combination of analytic estimation and numerical simulation, guided by previous assessments of the Kagome configuration. An optimization based on a genetic algorithm has been used to determine the best placement of a limited number of actuators in the structure for a given set of target shapes. The force capability of the actuators and failure threshold loads of the structure were observed in the optimization. Possible applications of such a multi-shape morphing structure are airfoils or mirrors.