Sym. G : Electro-packaging
BONDING TECHNOLOGY

E-WED-02

FABRICATION OF 4X4 SEMICONDUCTOR OPTICAL SWITCH MODULE USING LASER WELDING TECHNIQUE, S. G. KANG, M. K. SONG, S. S. PARK, S. H. LEE, N. HWANG, H. T. LEE, K. R. OH AND K. E. PYUN(Semiconductor Division, ETRI, 161 Kajong-Dong, Yusong-Gu, Taejon, 305-350, Korea)

4x4 semiconductor optical switch module for 1550nm optical communication system was fabricated by using laser welding technique based on the 30-pin butterfly package. For better coupling efficiency between switch chip and optical fiber, tapered fibers of 10~15μm lens radius fabricated at ETRI were used, which provided up to 60% optical coupling efficiency. The lens to lens distance of the assembled tapered fiber array was sufficiently accurate within +/- 0.5μm. U-channel technique made it possible to align the optical fiber array to chip with all possible degrees of freedom(x, y, z, θ_x, θ_y, θ_z). After welding the components, fine adjustment is necessary to compensate the post weld shift. We introduced laser hammering technique to adjust radial shift, which was critical in obtaining comparable optical coupling efficiencies for each channel, simultaneously. The fabricated optical switch modules showed good thermal stability of less than 5% degradation after 200 times thermal cycling test. We inserted the switch modules in the 2.5Gbps transmission system and investigated the module characteristics such as switching performance, transmission property and power penalty.

E-WED-03

DIRECT WAFER BONDING BETWEEN DIFFERENT SEMICONDUCTOR MATERIALS AND APPLICATION OF SEMICONDUCTOR LASERS, T. R. CHUNG, N. HOSODA, and T. SUGA (Research Center for Advanced Scienceand Technology, The University of Tokyo, 6-1, Komaba 4-chome, Meguro-ku, Tokyo 153, Japan)

Direct bonding technique has recently reviewed a lot of attention, because this technique can be used to fabricate highly lattice-mismatched heterostructures without conventional any threading dislocation. In this paper, we report the surface activated bonding (SAB) method of different semiconductor wafers were successfully bonded at room temperature. 1.3 μm InGaAsP/InP strained-layer quantum wells ridge waveguide lasers have been successfully fabricated on a GaAs substrate by the surface activated wafer direct bonding method at room temperature. In this method, the surfaces of two wafers are activated by Ar fast atom beam irradiation and mated in a high vacuum. A high bonding strength was attained. No microcracks and voids were found under transmission electron microscopy(TEM). A threshold current density of 500 mA/cm^2 was achieved. This technique is very promising to realize a monolithic of optoelectronic integrated circuits for optical communications and interconnections.

Sym. G : Electro-packaging
SOLDERS & SOLDER JOINTS

E-WED-04

The Microstructure and Properties of Solder Joints, J. W. Morris, Jr.(Dept. of Materials Science, University of California, Berkeley, and Center for Advanced Materials, Lawrence Berkeley National Laboratory)

Solder joints in microelectronics devices consist of low-melting solder compositions that wet and join metal contacts and are, ordinarily, used at high homologous temperatures in the as-solidified condition. Differences in solidification rate and substrate interactions have the consequence that even solder joints of similar compositions exhibit a wide range of microstructures. The variation in microstructure causes a variation in properties; in particular, the high-temperature creep properties that govern much of the mechanical behavior of the solder may differ significantly from joint to joint. The modern trend toward ultrafine-pitch solder joints raises new questions as the joints take on dimensions that are commensurate with the scale of the microstructure and the dimensions of common interfacial flaws, and are used in arrays whose properties are influenced most strongly by their weakest members.

E-WED-05

ALLOY DESIGN OF Sn-Zn- and Sn-Ag-BASED MULTICOMPONENT SOLDER SYSTEMS AIDED BY THERMODYNAMIC CALCULATIONS, WON KYOUNG CHOI and HYUCK MO LEE (Dept. of Mater. Sci. and Eng., KAIST, Taejon, 305-701, Korea)

Thermodynamic studies of multicomponent Sn-Zn-based and Sn-Ag-based systems have been made in terms of phase equilibria to design Pb-free solder alloys. Based on phase equilibrium calculations, several specific alloy compositions were selected and analyzed by DSC. They were also compared with predicted phase transition and melting temperatures. Microstructures of as-cast and heat-treated alloys were examined through SEM and XRD analysis. Mechanical and spreading area tests were carried out to investigate physical properties of solder alloys. Intermetallic compounds formed at the interface between solder and substrate were examined and its formation was explained through thermodynamic considerations.