principle that crystallization of a melt is inhibited if it contains atoms differing widely in size.

Egami and *Waseda*'s analysis is not directly applicable to ternary alloys, but it is interesting to note that the rare earth solute atoms are always larger than the aluminum solvent, while the transition metal atoms are smaller. By way of example, atomic volumes for two of the new aluminum glasses (in Å^3) are: Al 16.6, Ce 34.4, Fe 11.8;—,Y 33.0, Ni 10.9. The implication is that a mixture of small and large solute atoms is particularly favorable for stabilizing a liquid/amorphous structure and discouraging crystallization. This conclusion is consistent with one of the few earlier studies that looked systematically at ternary glasses: *Ohnuma* et al.[6] examined a range of Co-B-TM alloys, where various transition metals were partially substituted for boron. It was found that the total solute content needed to achieve vitrification was the smaller, the larger the size of the transition metal atom: in general, the larger the disparity between the size of the solvent (cobalt) atom and the sizes of the (larger) transition metal and (smaller) boron solutes, the easier it was to make a glass.

The practical interest of the new glasses lies in their strength. *He* et al. found tensile strengths in the range 670–940 MPa, while *Inoue* et al. reported values in the range 730–1140 MPa for various compositions in their single alloy system. These strengths greatly exceed the strengths of even the best precipitation-hardened crystalline aluminum alloys (300–500 MPa) and the possibility of using ribbons of some of the new alloys as reinforcing fibers in composites at once presents itself. Advantages include in particular the low density of the fibers, their ductility which offers the prospect of enhanced intrinsic ductility in composites incorporating them, as well as good corrosion resistance. Drawbacks include a relatively low Young's modulus (up to 71 GPa), somewhat lower than for crystalline aluminum alloys, and rather low crystallization temperatures, 250–370 °C for the compositions of greatest interest. However, this is still higher than the limiting temperature of use for organic fibers such as Kevlar.—The *Wall Street Journal* for October 6 carried a report of an interview with a staff scientist of Allied-Signal Corporation which is the principal commercial manufacturer of metallic glasses. This scientist very reasonably doubted whether the new glasses could be used as massive constructional materials, but made no reference to use in composites. The Virginia authors, also interviewed, expressed the belief that the aluminum glasses have a rosy future in the aerospace industry.

Research on metallic glasses, which excited a steadily high level of interest during the 1970s and early 1980s,[7] has shown signs of abating recently. Perhaps the new aluminum glasses will inject a new vitality into this field: certainly many questions related to the formation, properties and crystallization of these glasses deserve to be addressed.

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Conference Reports

High-Temperature Superconductors in Strasbourg ...

The symposium on preparation and applications of high-temperature superconductors at the European Materials Research Society (E-MRS) conference on November 8–10, 1988 in Strasbourg, France attracted more than 200 scientists from Europe and overseas. Thirty-eight lectures, 15 of which were invited, and over 100 posters were presented in ten sessions. Most presentations discussed the structure of $YBa_2Cu_3O_7$ and Bi- and Tl-based superconductors, including the effect of substitutions and impurities. Other areas of interest were the preparation and characterization of thin film superconductors as well as bulk and thin film properties and their measurement by a variety of techniques such as X-ray photoelectron spectroscopy, Raman spectroscopy, nuclear magnetic resonance, etc. In addition, practical applications such as a Meissner-Ochsenfeld motor constructed by AEG engineers were presented during one of the two poster sessions.

A new phase in the Y-Ba-Cu-O system, namely $Y_2Ba_4Cu_8O_{16}$, which was reported at the Interlaken meeting earlier this year to be present in some thin films, can now be prepared in bulk form, as *E. Kaldis* (ETH Zürich) explained during his presentation. This so-called 248-phase has a T_c of 80 K. The critical current density is comparable to that in the 123-phase, but the 248-phase shows a significantly improved oxygen stability.

A number of presentations discussed the preparation and properties of Bi-Sr-Ca-Cu-O and Tl-Ba-Ca-Cu-O superconductors. In both systems two superconducting phases with $T_c > 77$ K exist. While in the Tl-system it is possible to isolate the high-T_c and low-T_c phases, this is not so in the Bi-based system. The formation of the low-T_c phase apparently proceeds much faster here than the high-T_c phase. Larger fractions of the high-T_c phase are observed after reaction times of 50 to 100 hours, while the low-T_c phase appears after only a few hours of sintering. In several presentations the stabilizing effect of Pb doping on the high-T_c phase in Bi-Sr-Ca-Cu-O was discussed. From X-ray spectra it would appear that the Pb enters the structure on the Bi sites, as *S. Amelinckx* (Univ. of Antwerp) reported. Other dopants, e.g. Nd, Sm or Gd, seem to reduce the amount of high-T_c phase in the Bi-Sr-La-Cu-O system, as shown on a poster by *M. Raveau* et al. (Univ. of Caen).

H. J. Scheel (Univ. of Geneva) summarized the activities on crystal growth of oxide superconductors. Impurities at a level as low as 0.1 wt.% interfere significantly with crystal growth, so the starting materials should be at least of 99.99% purity. Even though many groups are working on crystal growth of high-T_c superconductors, there are still no large untwinned single crystals of good quality available. One reason for this is insufficient knowledge of the phase diagrams under certain conditions, such as oxygen partial pressure, CO_2 content, etc. Even at this symposium dominated by materials scientists, a conspicuous lack of phase equilibria studies was apparent.

While the current carrying capability in sintered bulk high-T_c superconductors remains a problem because of small coherence lengths, anisotropy and granularity (*R. Flükiger,* Kernforschungszentrum Karlsruhe), the situation with thin film superconductors looks more promising. A large number of groups presented papers on the preparation and characterization of high-T_c superconducting thin films. A wide variety of methods, such as sputtering, thermal- and laser-evaporation, molecular beam epitaxy, etc., were employed to produce superconducting films, and a general distinction was made between in-situ processing and post-anneal processing. In-situ processing takes place in the presence of activated oxygen at relatively high pressures during deposition. Post-anneal processing requires additional oxygen annealing to crystallize the films following deposition. The primary advantage of in-situ processing over post-anneal processing, in addition to the fact that no additional oxygen annealing is necessary, is the lower substrate temperature (500 to 700 °C as compared to 800 to 900 °C, respectively), which helps to avoid film-substrate reactions. A further problem with films made by post-anneal processing is their high surface roughness which makes electronic applications of these films difficult or impossible (*A. Kapitulnik,* Stanford Univ.). An interesting approach was presented by *H.-U. Habermeier* (Max-Planck-Institut für Festkörperforschung, Stuttgart). He exposed his films to an oxygen plasma during deposition as an alternative to furnace annealing and showed it to be an excellent tool to restore the oxygen content of the films, even at temperatures as low as 300 °C. The most commonly used substrates were single crystalline $SrTiO_3$ and MgO, but also films deposited on yttria-stabilized zirconia, Al_2O_3, sapphire, $LiNbO_3$, and Si were discussed. In view of potential applications, in particular applications in connection with semiconductor devices, these substrates are of primary interest.

In conclusion, there were no sensational reports, and no spectacular new T_c records were announced; the fax machine in the conference office certainly did not run hot as it did at the Interlaken meeting at the beginning of the year. However, this does not mean that no progress was made in the field of high-T_c superconductors, only that the hectic phase of the research and development disappeared —at least for the time being. The dust of previous stampedes towards higher T_c has settled to make room for serious, systematic work towards a more complete understanding of these novel materials.

... and Colorado Springs

After the conference on Critical Currents in High-T_c Superconductors held in Snowmass Village in August of last year, Colorado was, once again, the site of a major superconductivity conference. This time it was the Conference on the Science and Technology of Thin Film Superconductors that took place on November 14–18, 1988 in Colorado Springs, Colorado, USA. Over 200 scientists and engineers from around the world attended this conference, which was organized by the U. S. Department of Energy (DOE), the Solar Energy Research Institute (SERI), the National Institute of Standards and Technology (NIST) (formerly National Bureau of Standards, NBS), The Naval Research Laboratory (NRL), and the Lawrence Berkeley Laboratory (LBL). Thirty-six invited and contributed papers, and more than 40 posters were presented on thin film deposition techniques, characterization, theory, device design and ap-