Utilization of Pressure for the Improvement of Metals and Alloys.

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It is no doubt, as a rule, the properties of metals and alloys are not unconcerned in the pressure applied to them during their solidification. But it has been believed hetherto that its effects are not remarkable, and hence little attention has been paied on this problem. In die casting methode the pressure is actually used, but the improvement in properties of the casting is commonly explained by means of the popular concept, namely, 'soundcasting.' Thus we have almost no concrete knowledge for the effects of pressure on metals and alloys. Our experience which will be mentioned below, however, seems to show us the importance of the fundamental study on the pressure.

The present authors investigated the effects of pressure on several aluminium alloys and low melting alloys, and have observed very remarkable facts. When the applied pressure is quite high, remarkable improvement in mechanical properties are observed, and which are more remarkable in ductility than in strength and more sensible against the dynamic stress than for the static one, that is, with the pressure about 60 kg cm^2, the increase of 60~80% in strength and of 200~300% in elongation is brought about. Further, from the relation between the pressure and the properties, we may expect the increase of 200~300% in strength and of 500~600% in elongation with the use of pressure several thousands kg/cm^2.

The alloys treated as mentioned above also show a marked change in their structure. Generally, the forms and the distribution of the constituents are changed : the primary and the eutectic crystals appear very fine, crystal grains are changed to irregular and angular shape from granular one, their boundaries lose the transition layer and assume a sharp and intriate form, and in paticular cases, the so-called modified silumin structure is obtained in Al-Si alloys.

As stated above, quite distinctive effects of the pressure applied during the solidification of metals and alloys assuredly appear in their properties. And now, we want to accentiate the necessity of re-inspection of the problem 'the use of pressure for the improvement of metalic materials.'