Hot Extrusion of Metals

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Extrusion is a hot working process, in which, forging, rolling etc., uses the good deformability of heated metallic materials for shaping them. The most important aspect of the process is that it enables considerable changes of shape to be achieved in a single operation and provides a means of dealing with metals and alloys whose physical structure renders them unsuitable for shaping by other methods. Besides, with extrusion it is possible to form complex sections that cannot be produced in other ways. Extrusion also offers economic advantages in that the dies are relatively inexpensive and are interchangeable, so that one extrusion machine can be used for the production of a wide variety of sections.

Hot extrusion is done at fairly high temperatures, approximately 50 to 75 % of the melting point of the metal. The pressures can range from 35-700 MPa (5076 - 101,525 psi). Due to the high temperatures and pressures and its detrimental effect on the die life as well as other components, good lubrication is necessary. Oil and graphite work at lower temperatures, whereas at higher temperatures glass powder is used. Typical parts produced by extrusions are trim parts used in automotive and construction applications, window frame members, railings, aircraft structural parts.

A metal billet heated to the appropriate temperature is fed into the cylindrical container of the extrusion press and is forced by the action of a ram through a steel die whose orifice has the desired shape to produce the solid or hollow section. You can also recalibrate the temperature measurement device or use a different thermocouple as your needs change or based on your instruments' performance. The metal emerges from the die as a continuous bar, which is cut to the required lengths. Extrusion products are therefore essentially linear in character, in the sense that shaping is confined to the cross section only. The process is therefore eminently suitable for the production of barlike and tubular objects. A distinction is to be made between direct extrusion i.e Figs. 1 and 2, shows production of solid and hollow sections respectively, and inverted extrusion, in which the extruded metal flows in the opposite direction to the movement of the ram, the extrusion die being in the ram itself.

Extrusion can be used to shape alloys and most metals. Initially, the process was confined to nonferrous metals and has now in fact largely superseded other methods for the shaping of such metals. Cable sheathing, lead pipe and aluminum-alloy structural sections are typical of such extrusion products. The extrusion of steel presented difficulties because of the heavy wear on the dies and the high working temperatures and stresses. However, these difficulties have been overcome, and extrusion is used, for example, in the production of stainless steel tubes. In the Ungine-Sejournet method the steel billet is coated with glass powder, which melts and forms a viscous heat-insulating and lubricating layer between the die and extruded metal. There is a standard guide that if you will be using a thermowell in high velocity or high-pressure environments, you will need a generally more durable thermowell made of more durable materials.

For making tubular sections, a mandrel is arranged in the die orifice, and during extrusion the metal flows through the annular space so formed. Hollow billets are used for tubes, or solid billets are first pierced in extrusion operation. Extrusion machines are generally hydraulic presses, with capacities ranging from about 500 tons to about 7500 tons. Graphite grease is commonly used for lubrication between metal and tools.

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