

4 Designing Plastics Parts

The deformational behavior of polymeric materials depends mainly on the type and magnitude of loading, time of application of the load, and temperature. The deformation is related to these factors in a complex manner, so that the mathematical treatment of deformation requires a great computational effort [1]. However, in recent times computational procedures for designing plastic parts have been developed using stress-strain data, which were carefully measured by employing computer-aided testing of polymers [2].

4.1 Strength of Polymers

The basic equation for calculating the design stress of a part under load is given by [1]

$$\sigma_{v_{\max}} \leq \sigma_{zul} = \frac{K}{S \cdot A} \quad (4.1)$$

where

- K = material strength as a mechanical property
- $\sigma_{v_{\max}}$ = maximum stress occurring in the part
- σ_{zul} = allowable stress
- S = factor of safety
- A = material reduction factor

The relation between allowable stress and the polymer-dependent reduction factors can be written as [1]

$$\sigma_{zul} = \frac{K}{S} \cdot \frac{1}{A_{\theta}} \cdot \frac{1}{A_{st}} \cdot \frac{1}{A_{dyn}} \cdot \frac{1}{A_A} \cdot \frac{1}{A_W} \dots \quad (4.2)$$

The factor A_{θ} considers the influence of temperature on the strength of the material and can be calculated from [1]

$$A_{\theta} = \frac{1}{1 - [k(\Theta - 20)]} \quad (4.3)$$

where Θ = temperature. The limits of applicability of Equation 4.3 are $20 \leq \Theta \leq 100$ °C.

The value k based on the reference temperature of 20 °C is given for the following materials as [1]

PA66	= 0.0112
PA6	= 0.0125
PBT	= 0.0095

Design Formulas For Plastics Engineers With 90 Figures

Marlene G. Rosato, D.V. Rosato



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Design Formulas for Plastics Engineers Natti S. Rao, Günter Schumacher, 2004 Although designing machines and dies for plastics processing is routinely done with the help of computer modeling and design programs the results don't always hold up in industrial application Therefore it is essential for the designer to have an understanding of the underlying mathematical concepts and their limitations when working with these programs and or trying to improve their output This book presents a summary of the most important formulas and their applications to solve design and processing problems with plastics materials Numerous practical examples guide the reader step by step through the computational routine of designing polymer machinery The approach is unassuming and very practical to enable every engineer to apply these concepts in their daily work and improve their equipment and stabilize their processes

Plastics Design Handbook Marlene G. Rosato, D.V. Rosato, 2013-11-27 This book provides a simplified and practical approach to designing with plastics that fundamentally relates to the load temperature time and environment subjected to a product It will provide the basic behaviors in what to consider when designing plastic products to meet performance and cost requirements Important aspects are presented such as understanding the advantages of different shapes and how they influence designs Information is concise comprehensive and practical Review includes designing with plastics based on material and process behaviors As designing with any materials plastic steel aluminum wood etc it is important to know their behaviors in order to maximize product performance to cost efficiency Examples of many different designed products are reviewed They range from toys to medical devices to cars to boats to underwater devices to containers to springs to pipes to buildings to aircraft to space craft The reader's product to be designed can directly or indirectly be related to product design reviews in the book Important are behaviors associated and interrelated with plastic materials thermoplastics thermosets elastomers reinforced plastics etc and fabricating processes extrusion injection molding blow molding forming foaming rotational molding etc They are presented so that the technical or non technical reader can readily understand the interrelationships

Design Formulas for Plastics Engineers Natti S. Rao, 1991-01-01 *Society of Plastics Engineers Annual Technical Conference* Society of Plastics Engineers, 1977 *Mechanical Engineer's Reference Book* Edward H. Smith, 2013-09-24 *Mechanical Engineer's Reference Book* 12th Edition is a 19 chapter text that covers the basic principles of mechanical engineering The first chapters discuss the principles of mechanical engineering electrical and electronics microprocessors instrumentation and control The succeeding chapters deal with the applications of computers and computer integrated engineering systems the design standards and materials properties and selection Considerable chapters are devoted to other basic knowledge in mechanical engineering including solid mechanics tribology power units and transmission fuels and combustion and alternative energy sources The remaining chapters explore other engineering fields related to mechanical engineering including nuclear offshore and plant engineering These chapters also cover the topics of manufacturing methods engineering

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