This book includes ten chapters that explore how materials and design are connected. An understanding of materials and manufacturing (M&M) is a core element of the design process. It is our intention to build a solid foundation of information and knowledge around M&M and to encourage a passion for the exploration and manipulation of M&M in the context of design.

In the appendix to these chapters, exercises for students and working designers have been outlined for each chapter and more detailed maps of technical information have been included for reference.
Chapter 1

Function and Personality
We live in a world of materials; it is materials that give substance to everything we see and touch. Our species – *homo sapiens* – differs from others most significantly, perhaps, through the ability to *design* – to make things out of materials – and in the ability to see more in an object than merely its external form. Objects can have meaning, carry associations or be symbols of more abstract ideas. Designed objects, symbolic as well as utilitarian, predate any recorded language – they provide the earliest evidence of a cultural society and of symbolic reasoning.

Some of these objects had a predominantly functional purpose: the water wheel, the steam engine, the gas turbine. Others were (and are) purely symbolic or decorative: the cave paintings of Lascaux, the wooden masks of Peru, the marble sculptures of Attica. But most significantly, there are objects that combine the functional with the symbolic and decorative. The combination is perhaps most obvious in architecture – great architects have, for thousands of years, sought to create structures that served a practical purpose while also expressing the vision and stature of their client or culture: the Coliseum of Rome, the Empire State Building of New York, the Pompidou Centre of Paris, each an example of blending the technical and the aesthetic.

On a smaller scale, product designers seek to blend the technical with the aesthetic, combining practical utility with emotional delight. Think of Wedgwood china, Tiffany glass, Chippendale furniture – these were first made and bought to fulfill a functional purpose, but survive and are treasured today as much for their appeal as objects of beauty. Think, too, of musical instruments: the inlaid violin or harpsichord; of weapons of war: the decorated shield or carved details in a gun; or of the weapons of the mind: the gilded pen, the illuminated manuscript. All of these are tools made in forms that express aspects of their creator’s imagination and desire to make objects of delight as well as of utility (1.1 and 1.2).

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For materials and design, it is the combination of elements of art and science that make it work. Materials are not simply numbers on a datasheet. And design is not a meaningless exercise in styling and it is not an isolated exploration of technology. What matters is the process of finding solutions that are meaningful to people, that enable new experiences and inspire and create positive impact in society and in our own daily lives. Today, people are looking for products that are sustainable and lovable, and it is the job of a designer to create those products. We need to evolve from an industrial society that is driven by consumerism to one that respects and admires materiality and efficiency. To explore materiality, we need to get inside the factory and meet the craftsmen and -women that make our products. To make decisions about efficient use of materials, a basic foundation of technical knowledge of materials and manufacturing is required. In combination, materiality and efficiency allow the designer to create products that are creative and yet fully optimized tangible expressions of an idea. It is this idea that will go-to-market.

People – consumers – buy things because they like them – love them, even. To succeed, a product must, of course, function properly, but that is not enough: it must be easy and convenient to use, and it must have a personality that satisfies, inspires, gives delight (1.3). This last – personality – depends strongly on the industrial design of a product. When many technically equivalent products compete, market share is won (or lost) through its visual and tactile appeal, an exploration of other senses or emotional connection, the associations it carries, the way it is perceived and the experiences it enables. Consumers now expect delight as well as function in everything they purchase. Creating it is a central part of design.

Advances in materials enable advances in industrial design, just as they do for technical design - together these advances allow new behaviors, new experiences, new architectures (1.4). And here we need a word that requires definition: “inspiration” – the ability to stimulate creative thinking. New developments in materials and processes are sources of inspiration for product designers, suggesting novel visual, tactile, sculptural and spatial solutions to product design. Examples drawn from the recent past are the ability to color and mold polymers to make bright, translucent shapes; the co-molding of elastomers to give soft, tactile surfaces; toughened and textured glass to create...

1.2 Mixing Delightful Decoration and Utilitarian Function

A Colt pistol
transparent walls and flooring; surface coatings that reflect, refract or diffuse light; carbon fiber composites that allow exceptionally slender, delicate structures – and there are many more. In each of these examples innovative products have been inspired by the creative use of materials and processes.

Thus materials have two overlapping roles: that of providing technical functionality and that of creating product personality. It is here that an imbalance becomes apparent. Technical designers have ready access to information of the sort they need – handbooks, selection software, advisory services from material suppliers – and to analysis and optimization codes for safe, economical design. Industrial designers express frustration, both in print and in interviews, that they do not have equivalent support. In higher education the same discrepancy appears: the teaching of the science and technical application of materials is highly developed and systematized, supported by numerous texts, software, journals and conferences; there is no similar abundance of support for the teaching of materials in industrial design.

Bridging this gap in information and methods is not simple. The technical terms used by engineers are not the normal language of industrial designers – indeed they may find them meaningless. Industrial designers, on the other hand, express their ideas and describe materials in ways that, to the engineer, sometimes seem bewilderingly vague and qualitative. The first step in bridging the gap is to explore how each group “uses” materials and the nature of the information about materials that each requires. The second is to explore methods, and, ultimately, design tools, that weave the two strands of thinking into a single integrated fabric. That, in two sentences, is what this book is about.

1.3 Function, Use and Personality
A bicycle must function (wheels, chain, gears), be designed for use (to carry stuff from one place to another), and have a personality that fits its owner (decoration on the frame, handlebar tape).

1.4 A Virtual Violin
The form of the violin is an essential part of its personality. In this electronic violin, the ghost-like form both makes the connection to the original and suggests the transmutation that has taken place. (Image courtesy Yamaha Corp.)
Further Reading

There is a considerable literature on product design, some of it comprehensible, some not. Useful sources are listed, with ISBN number and a brief commentary, at the end of each Chapter. Those listed below are a good starting point.


Further Reading

McDermott, C. (1999) “The Product Book,” D & AD in association with Rotovison, UK. (50 essays by respected designers who describe their definition of design, the role of their respective companies and their approach to product design.)
