

# Advanced Structured Materials

## Volume 6

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Common engineering materials reach in many applications their limits and new developments are required to fulfill increasing demands on engineering materials. The performance of materials can be increased by combining different materials to achieve better properties than a single constituent or by shaping the material or constituents in a specific structure. The interaction between material and structure may arise on different length scales, such as micro-, meso- or macro-scale, and offers possible applications in quite diverse fields.

This book series addresses the fundamental relationship between materials and their structure on the overall properties (e.g. mechanical, thermal, chemical or magnetic etc.) and applications.

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- biomaterials
- nano porous metals
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- coated materials
- smart materials

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# Hybrid Adhesive Joints

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ISSN 1869-8433  
ISBN 978-3-642-16622-8  
DOI 10.1007/978-3-642-16623-5  
Springer Heidelberg Dordrecht London New York

e-ISSN 1869-8441  
e-ISBN 978-3-642-16623-5

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*Cover design:* eStudio Calamar, Berlin/Figueras

Printed on acid-free paper

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# Preface

Adhesively bonded joints are increasingly being used in aerospace and automotive industries. The use of adhesive bonding rather than mechanical fasteners offers the potential for reduced weight and cost. However, there are still a number of issues that need to be solved before this technique is fully trusted by the industry. Due to the polymeric nature of the adhesive, the joint resistance to harsh environments (temperature and humidity) and its durability must be taken into account. Another point is the fact that the stress distribution is concentrated at the ends of the overlap giving rise to premature failures, especially with composites. However, when used in combination with traditional methods of joining such as bolts, rivets or spot welds, part of the problem can be solved. That is why adhesively bonded joints with different methods of joining are being considered. The idea is to gather the advantages of the different techniques leaving out their problems. Some of the advantages of hybrid joints are a higher static and fatigue strength and a higher stiffness with respect to simple joints, a two-stage cracking process before the final failure and improved durability. They also offer the technological advantage of keeping parts in place while the adhesive is curing. That is why hybrid joining is increasingly used by the automotive industry. Another possibility to increase the joint strength of simple adhesive joints is to use more than one adhesive along the overlap. All these joints are treated here: weld – adhesive, rivet – adhesive, clinch – adhesive, bolt – adhesive, and adhesive – adhesive. A section dedicated to threadlocking and interference-fit adhesive joints is also included. All sections are treated from a scientific point of view with modelling issues supported by simple coupons testing and a technological point of view where the idea is to present more applied results with practical cases.

The editors would like to thank the authors for their patience with the preparation of this book. Finally, we especially thank Dr Christoph Baumann, Springer editor, who made this book possible.

Dr. Lucas F M da Silva  
Prof. Alessandro Pirondi  
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# Contents

<b>Science of Weld: Adhesive Joints</b> . . . . .	1
Saied M. H. Darwish	
<b>Technology of Weld-Adhesive Joints</b> . . . . .	37
Holger Gaul and Gert Weber	
<b>Technology of Rivet: Adhesive Joints</b> . . . . .	79
Fabrizio Moroni and Alessandro Pironi	
<b>Science of Clinch-Adhesive Joints</b> . . . . .	109
Alessandro Pironi and Fabrizio Moroni	
<b>Technology of Clinch-Adhesive Joints</b> . . . . .	149
Tomasz Sadowski and Tadeusz Balawender	
<b>Science and Technology of Bolt-Adhesive Joints</b> . . . . .	177
Jan R. Weitzenböck and Dag McGeorge	
<b>Science of Friction-Adhesive Joints</b> . . . . .	201
Eugenio Dragoni and Pierfranco Mauri	
<b>Technologies of Threadlocking and Interference-Fit Adhesive Joints</b> . . . . .	227
Felix Kleiner and Wolfgang Fleischmann	
<b>Science of Mixed-Adhesive Joints</b> . . . . .	257
James G Broughton and Michael D Fitton	
<b>Technology of Mixed Adhesive Joints</b> . . . . .	283
Lucas F. M. da Silva	