

Substitution von metallischen Schubfeldern im Fahrzeugbau durch fügetechnische Integration von FKV-Schalen

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Durch den strukturellen Einsatz von Faser-Kunststoff-Verbunden (FKV) lassen sich hochwertige gewichtsoptimierte Karosserien in Mischbauweise umsetzen. Zur Ausschöpfung des vollen Leichtbaupotentials der FKV müssen werkstoffgerechte Fügeverfahren entwickelt werden. Die untersuchte Pin-Schweißtechnik zur Verbindung von thermoplastischen Organoblechen mit Stählen bietet, im Vergleich zu anderen Verfahren, neben einer einseitigen Zugänglichkeit, ein hohes Leichtbaupotenzial.

Auf Basis experimenteller und numerischer Untersuchungen wurde eine Methode zum Vorwärmen von Organoblechen mittels Infrarotstrahlung entwickelt. Die Eignung der Pin-Schweißtechnik wurde sowohl für das Fügen von karbon- als auch glasfaserverstärktem PA6 betrachtet. Als Bewertungskriterien wurden das Schweißgut sowie der Faser- und Matrixerhalt in Abhängigkeit der Schweißparameter untersucht. Die mechanische Beanspruchbarkeit des entwickelten Verfahrens wurde in Scherzugversuchen ermittelt.

1 Motivation

Im Automobilbau finden die kunststoffbasierten Kompositwerkstoffe, insb. Faserkunststoffverbunde (FKV), durch ihr hohes Leichtbaupotential immer mehr Bedeutung [1-3]. Durch den strukturellen Einsatz lassen sich in Kombination mit hochfesten Stahllegierungen gewichtsoptimierte Karosserien in Mischbauweise ideal umsetzen, wenn die hohen Kräfte von der metallischen Struktur in die FKV-Komponente werkstoffgerecht geleitet werden können. Herkömmliche mechanische Fügeverfahren führen nach aktuellem Stand der Technik zu Strukturschädigungen im FKV, etwa durch spanende Vorlochoperationen für das Blindnieten, Schrauben sowie für Schließringbolzen oder durch das Setzen von Stanznieten. Infolge des unterbrochenen Kraftflusses (durchtrennte Fasern) werden an der Verbindungsstelle versagenskritische Korbspannungsüberhöhungen induziert, welche die Tragfähigkeit der gesamten Verbindung erheblich herabsetzen [4]. Daher müssen die FKV-Bauteile bisher im Fügebereich dicker oder mit stark überdimensionierten Anschlussflanschen ausgeführt werden. Nicht faserschädigende Verfahren wie das Kleben [2,5] erfordern, dem Leichtbauansatz widersprechend, große Überlappbereiche. Zudem stellen die mehrstufigen, manuellen Arbeitsschritte zeit- und kostenaufwendige Vorarbeiten im Fügeprozess dar. Ein weiterer Nachteil besteht in der mangelnden Flexibilität der angewandten Fügeverfahren, weil bei neuartigen FKV-Bauteilen mit gradiertem Wandstärkenverlauf die Längen der Fügeelemente variieren müssen. Derartige Fügeprozesse sind schwer zu automatisieren und verringern bei Umrüstprozessen die Anlagenverfügbarkeit.

2 Pin-Schweißtechnik zum Fügen von Mischverbindungen

In dem Vorhaben wurde basierend auf der Pin-Technologie ein neuartiges Fügeverfahren für Mischverbindungen entwickelt (schematisch in Abb. 1). Als Verbindungselement dient dabei ein FKV-durchdringender Pin mit einem Schließkopf. Durch die kraftflussgerechte Gestaltung der Fügezone, indem die Fasern im FKV zerstörungsfrei erhalten bleiben und um den Pin herum verdrängt werden, ergeben sich anspruchsvolle Verbindungseigenschaften.

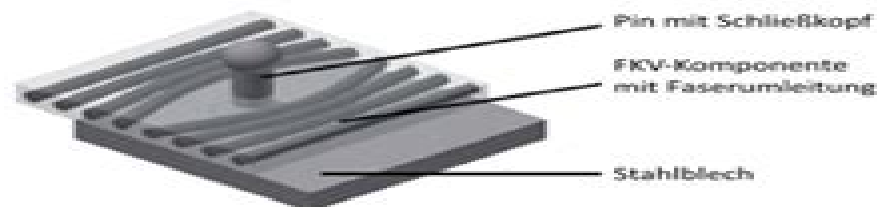


Abb. 1. Schematische Darstellung von FKV/Metall/Pin-Mischverbindung mit belastungsgerechter Faserorientierung

Die Fügeverfahren basiert auf einem neuartigen Verfahrensansatz, bei dem ein Schweißdraht eines MSG-Brenners das FKV-Material im Überlappbereich des Metall- und Organoblechs durchdringt. Sobald der Schweiß-

Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau

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The book delves into Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau.

Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau is a crucial topic that must be grasped by everyone, from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:

- Chapter 1: Introduction to Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau
- Chapter 2: Essential Elements of Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau
- Chapter 3: Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau in Everyday Life
- Chapter 4: Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau in Specific Contexts
- Chapter 5: Conclusion

2. In chapter 1, the author will provide an overview of Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau. The first chapter will explore what Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau is, why Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau is vital, and how to effectively learn about Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau.
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6. In chapter 5, this book will draw a conclusion about Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau. This chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. It is highly recommended for anyone seeking to gain a comprehensive understanding of Prozesskettengestaltung Serienf Hige Integration Metallischen Fahrzeug Rohbau.

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