

## **BSPT-Haftfestigkeit** **back side pressure test**

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DVM Berlin Dezember 2014

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## **BSPT – Haftfestigkeit**

**(back side pressure test)**

### **Gliederung**

- **Thermische Schutzschichten und Prüfmethoden**
- **Der back side pressure test (BSPT)**
- **Versuchsdurchführung**
- **Ergebnisse**
- **Erweiterungen und Zusammenfassung**

# BSPT – Haftfestigkeit

(back side pressure test)

## Gliederung

- Thermische Schutzschichten und Prüfmethoden

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# BSPT – Haftfestigkeit

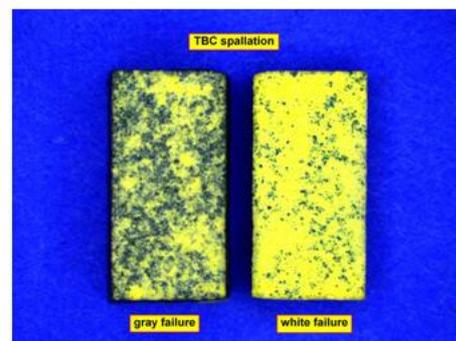
(back side pressure test)



typisches TBC-Versagen:

zwischen  
TBC und  
Substrat  
=  
gray failure

in der TBC  
=  
white failure



Delamination Kohäsionsbruch

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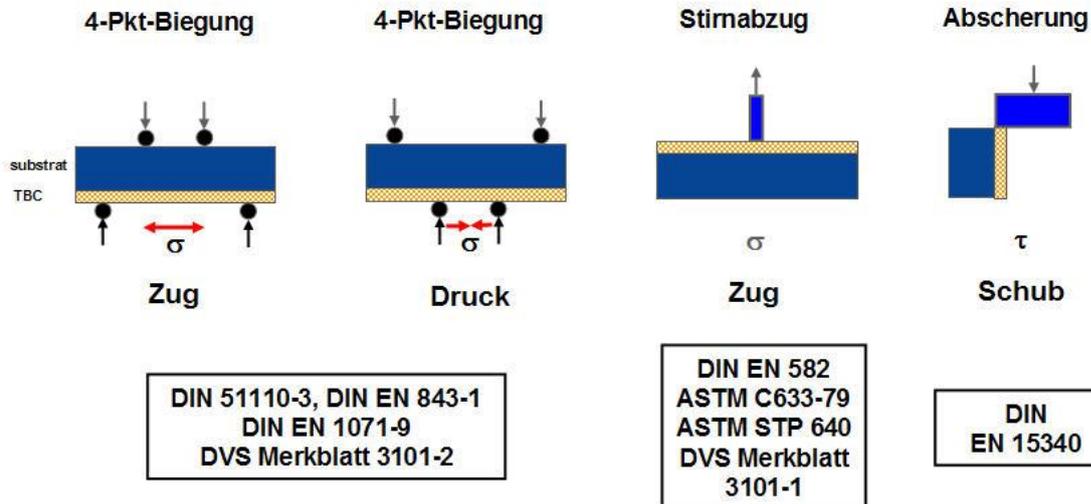
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# BSPT – Haftfestigkeit

(back side pressure test)

## typische TBC-Prüfmethoden



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# BSPT – Haftfestigkeit

(back side pressure test)

## Gliederung

- Thermische Schutzschichten und Prüfmethoden
- Der back side pressure test (BSPT)

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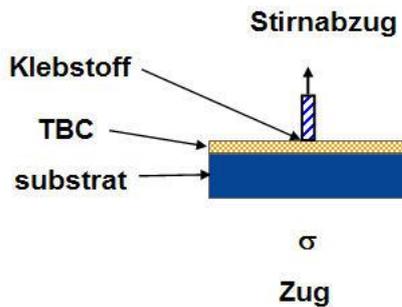
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# BSPT – Haftfestigkeit

(back side pressure test)

## Haftfestigkeit



?

- Bruch im Kleber
- Bruch am Zugstab
- Eindringen des Klebers in poröse Schichten
- Festigkeit des Klebers geringer als Kohäsion bzw. Delamination

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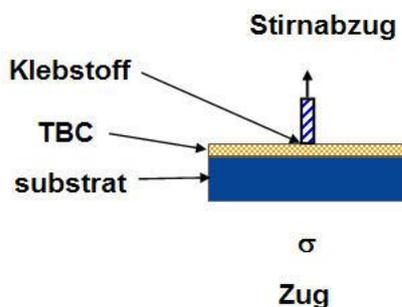
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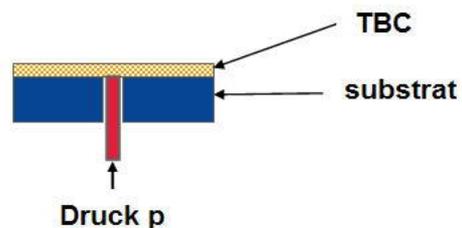
# BSPT – Haftfestigkeit

(back side pressure test)

## Haftfestigkeit



geht das auch so?



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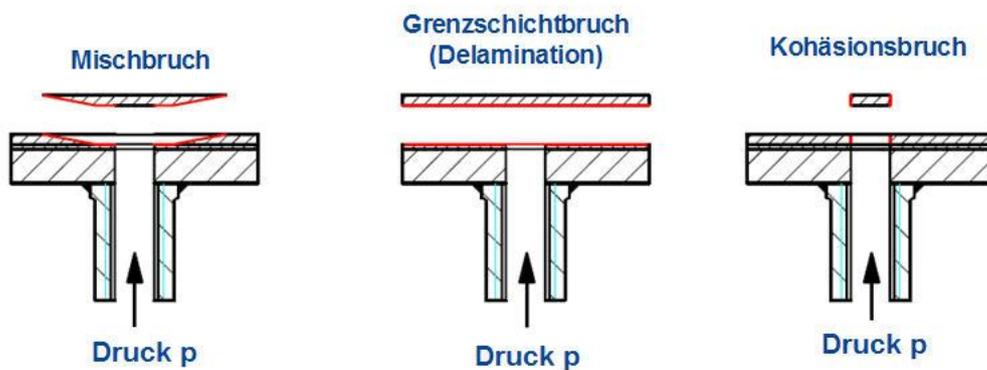
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## BSPT – Haftfestigkeit

(back side pressure test)

### TBC-Brucharten (thermal barrier coating)



(back side pressure test)

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## BSPT – Haftfestigkeit

(back side pressure test)

### Gliederung

- Thermische Schutzschichten und Prüfmethoden
- Der back side pressure test (BSPT)
- Versuchsdurchführung

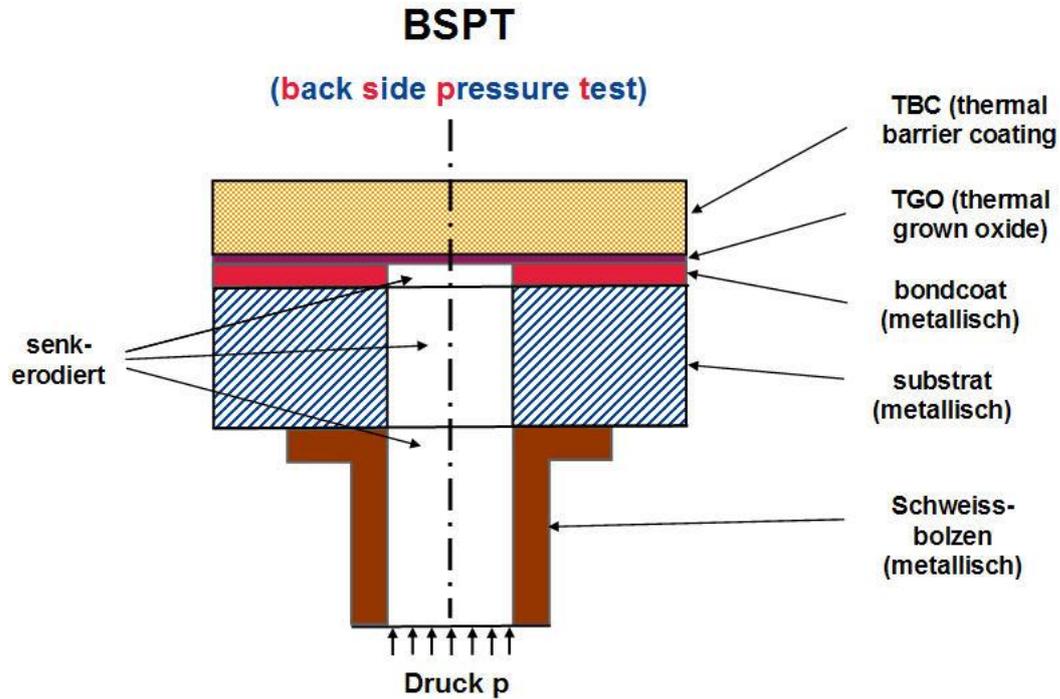
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(back side pressure test)



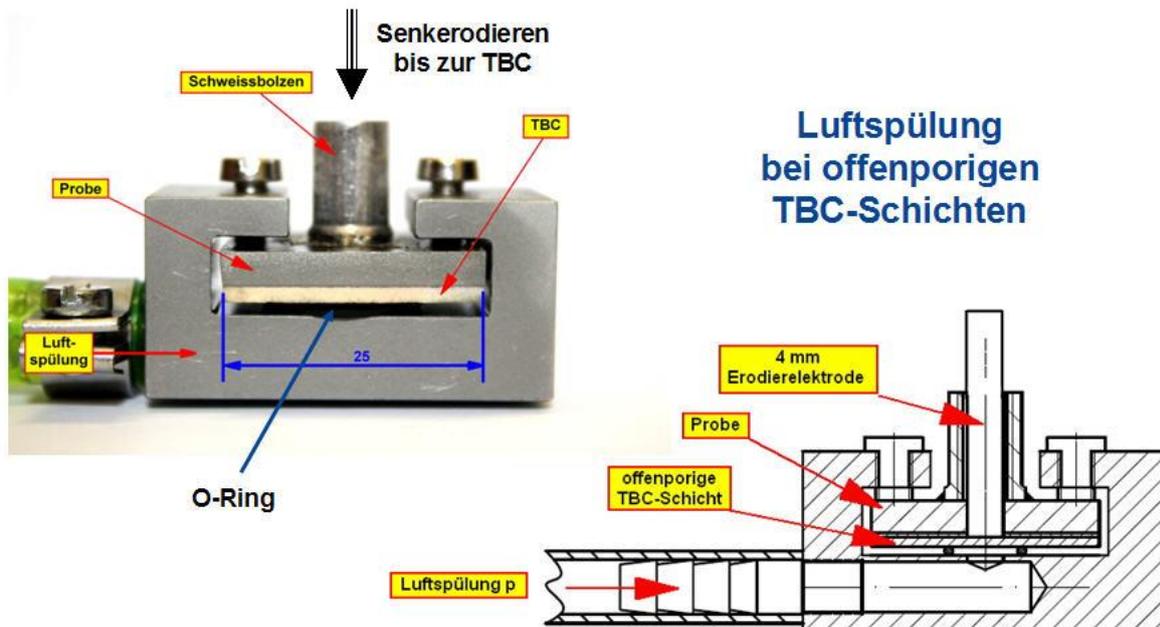
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# BSPT – Haftfestigkeit

(back side pressure test)



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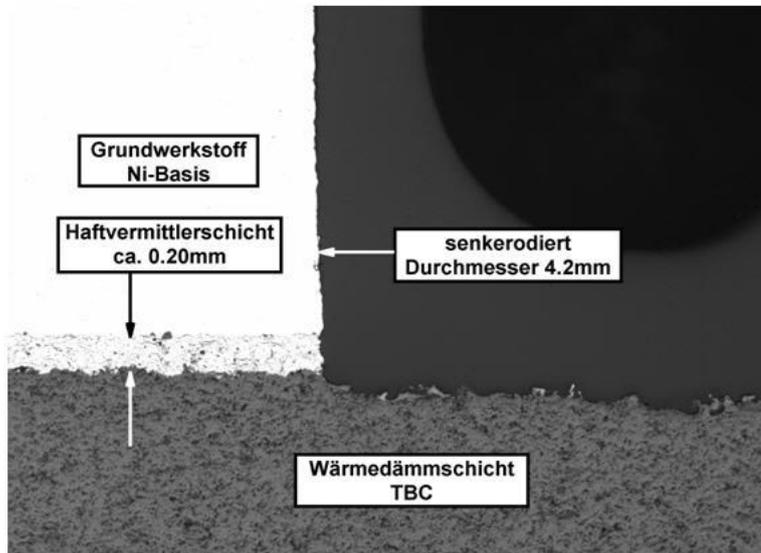
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# BSPT – Haftfestigkeit

(back side pressure test)

vor der Prüfung



senkerodierte  
Bohrung durch  
Substrat mit  
Haftvermittler-  
schicht

bis zur  
nicht leitenden  
TBC-Schicht

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(back side pressure test)

## Gliederung

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- Der back side pressure test (BSPT)
- Versuchsdurchführung
- Ergebnisse

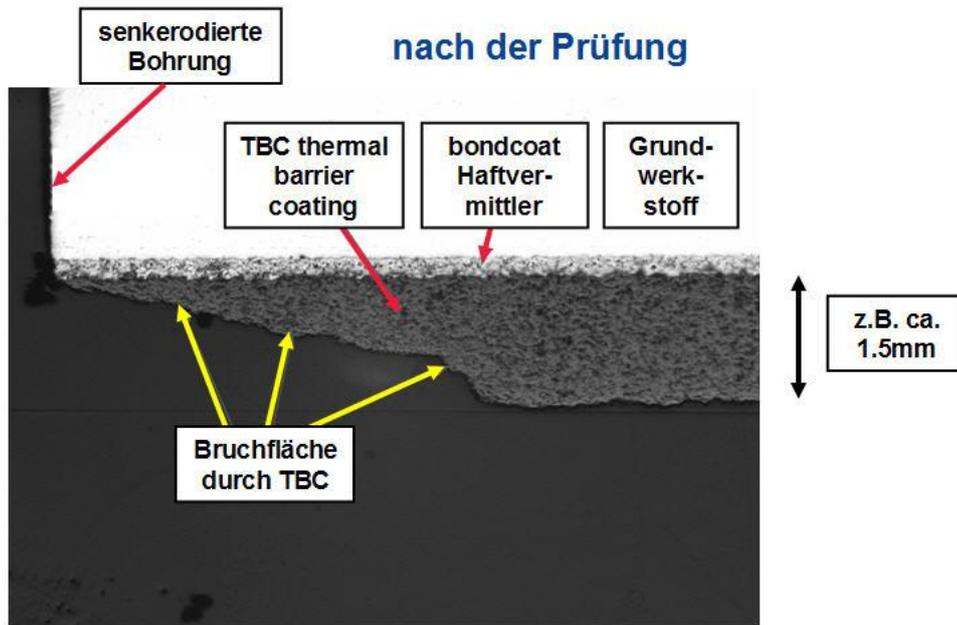
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# BSPT – Haftfestigkeit

(back side pressure test)



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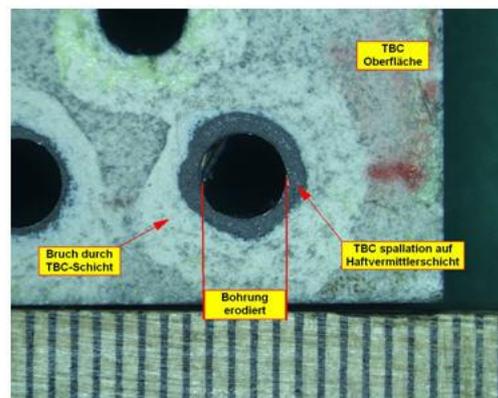
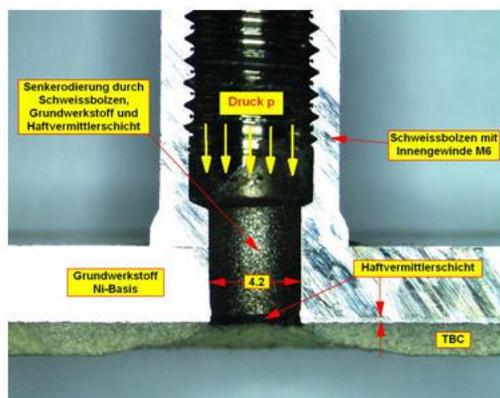
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# BSPT – Haftfestigkeit

(back side pressure test)

Querschliff durch senk-erodierte und geprüfte Probe

Versagensbilder abgeplatzter TBC-Oberflächen



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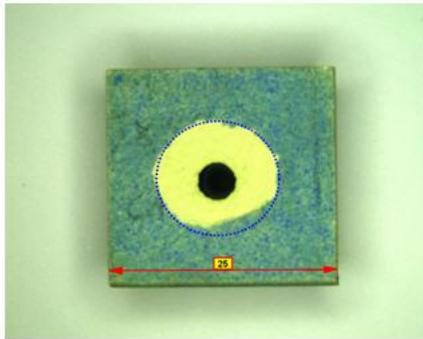
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# BSPT – Haftfestigkeit

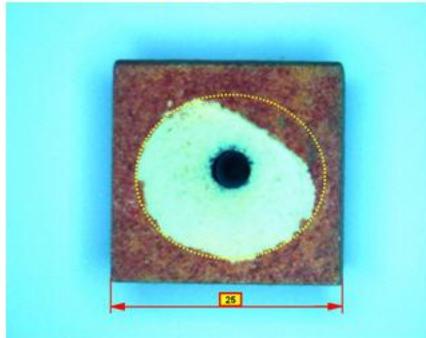
(back side pressure test)

Serie 1  
Neu-  
zustand

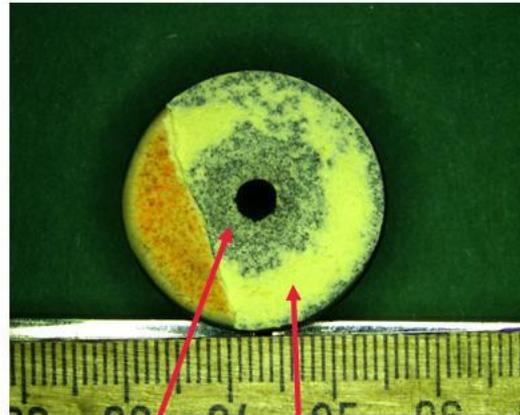


Bruch TBC

Serie 3  
geglüht  
1050°C/  
1501h



zyklisch thermisch gealtert  
im burner rig test



gray and white failure

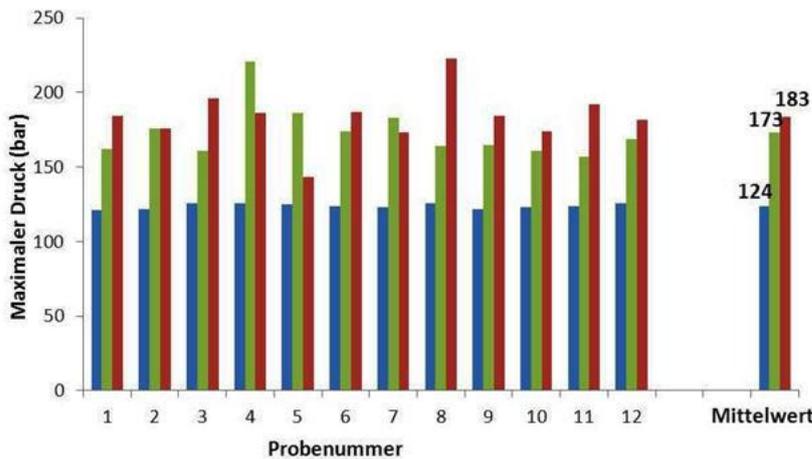
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(back side pressure test)



	Standardabweichung
Serie 1 Druck	1,81 bar
Serie 2 Druck	17,60 bar
Serie 3 Druck	18,36 bar

	Mittelwert	Standardabweichung	Probenmenge
Serie 1	124 bar	1,809 bar	12
Serie 2	173,3 bar	17,60 bar	12
Serie 3	183,3 bar	18,36 bar	12

**Zustand:**

neu

1050°C/786h

1050°C/1501h

Hochtemperaturglühung mit Sinterung

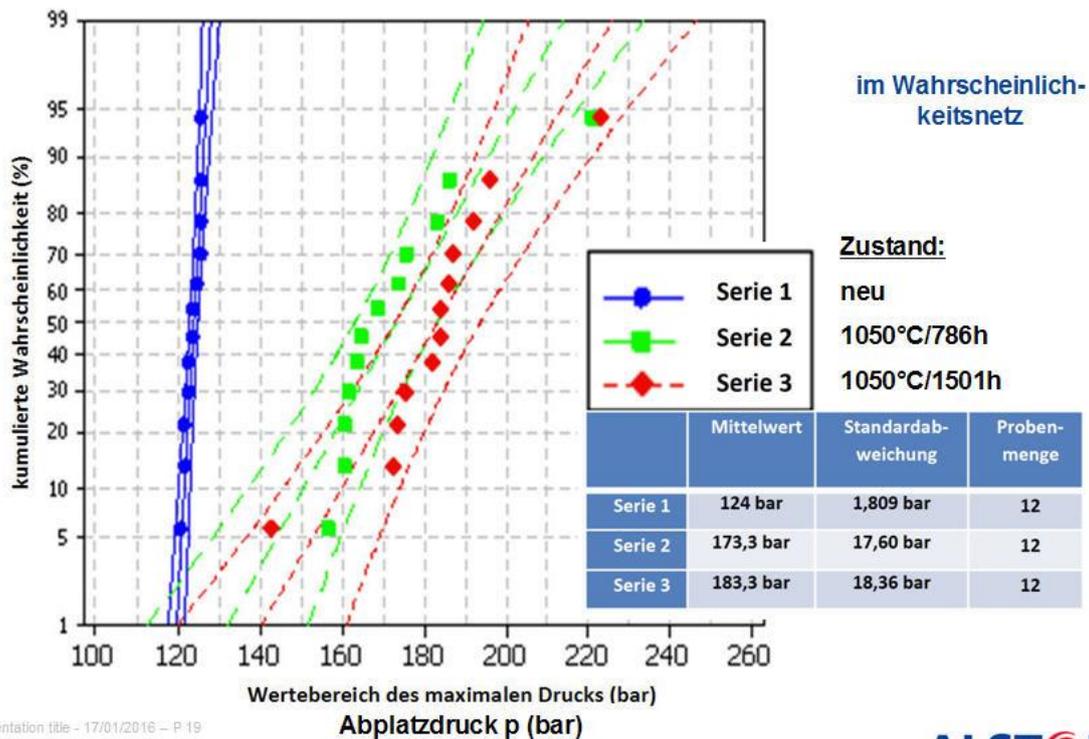
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(back side pressure test)

## Gliederung

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- Der back side pressure test (BSPT)
- Versuchsdurchführung
- Ergebnisse
- Erweiterungen und Zusammenfassung

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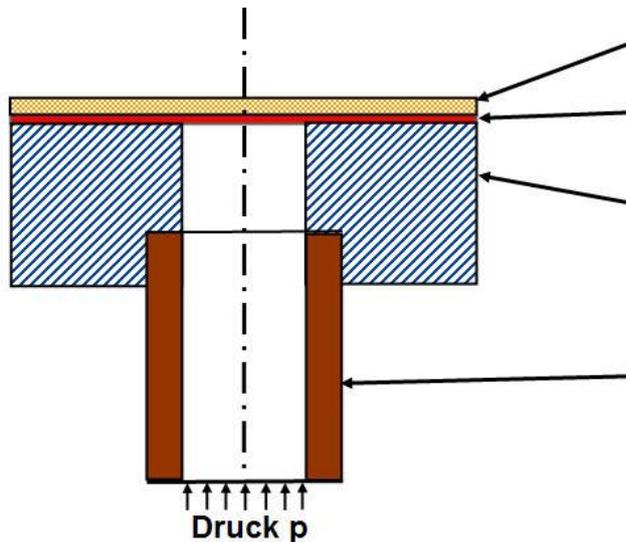
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# BSPT – Haftfestigkeit

(back side pressure test)

Entwicklung und  
Qualitätssicherung mit  
BSPT  
(back side pressure test)

Erweiterung auf Kleb-  
und Lötverbindungen



Kunststoff, Metall,  
Kleband, Keramik

Klebstoff, Lot

Grundplatte mit  
def. Oberfläche,  
vorher gebohrt

Schweiss- oder  
Schraubanschluss

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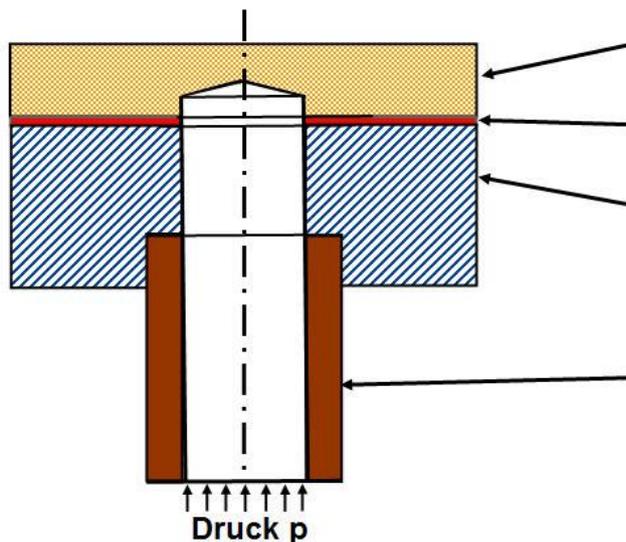
# BSPT – Haftfestigkeit

(back side pressure test)

Entwicklung und  
Qualitätssicherung mit  
BSPT  
(back side pressure test)

Erweiterung auf Kleb-  
und Lötverbindungen

nach  
dem  
Kleben  
bzw.  
Löten  
gebohrt



Kunststoff, Metall,  
Keramik mit  
def. Oberfläche

Klebstoff, Lot

Grundplatte mit  
def. Oberfläche

Schweiss- oder  
Schraubanschluss

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# BSPT – Haftfestigkeit

(back side pressure test)

## Zusammenfassung und Schlussfolgerungen

(BSPT: back side pressure test)

- keine Belastungsspitzen durch mech. Krafteinleitung
- Prüfung ohne Probeneinspannung
- Prüfung von kleinen Teilen und leicht gewölbten Flächen
- Prüfung von ex-service (vorgeschädigtem) Material
- Prüfung bei hohen und tiefen Temperaturen
- keine Probleme durch Klebfestigkeitsgrenzen
- Streuung und Standardabweichung klein
- Erweiterung auf Klebstoffe, Lötungen etc.

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