July 2013

DVS – DEUTSCHER VERBAND FÜR SCHWEISSEN UND VERWANDTE VERFAHREN E. V.	**Instructions on the production of microsections and the evaluation of thermally sprayed coatings** **Comparison between professional and defective microsection preparations**	DVS **Technical Bulletin DVS 2310-2**

Reviewed and unaltered version of the December 2007 issue

This is a continuation of the instructions on the production of microsections in DVS 2310-1, and includes micrographs produced in industrial plants, universities and metallography laboratories. The preparation instructions that are included in the appendix led to the results as documented. Alternative preparation methods can also lead to the same result.

Leaflet DVS 2310-2 contains a comparison between micrographs that have been prepared correctly and those that have been prepared incorrectly. This is intended to show that incorrect preparation can result in the structure of a sprayed coating being displayed incorrectly, and that it can become impossible to assess the actual structural condition.

In order to ensure reproducible quality, microsection preparation must therefore be carried out with semi- or fully automated grinding and polishing processes on suitable grinding and polishing machines.

In order to ensure reproducible preparation results, all the details of specimen preparation including specimen size, cutting method, embedding method, grinding and polishing agents, number of grinding and polishing cycles, clamping pressures, grinding and polishing times and other parameters must be clearly adhered to. See leaflet DVS 2310-1.

In order to avoid disputes the preparation procedure should be agreed between the contracting parties.

Appendix:
Overview of common problems in microsection preparation,
Table 1.
Preparation instructions, **Table 2.**
Micrographs, **Figures 1 to 16.**

Appendix

Table 1. Overview of common problems in microsection preparation.

Figure	Layer / substrate	Incorrect preparation	Appropriate preparation
1-4	Al_2O_3/NiCr 80/20 APS Substrate: Ni	Cracks caused by incorrect cutting (Bakelite-bonded SiC disc)	Appropriate cutting method (plastic-bonded diamond disc)
5, 6	NiCrBSi – HVOF Substrate: S235JR	Boundary layer etched	Photograph layer before etching
7, 8	ZrO_2 Substrate: S235JR	Layer detached through hot embedding	Cold embedding
9, 10	AlSi20 plasma Substrate: Al (6060)	Weak contrasting	Contrast-rich structure developed by colour etching in 5% molybdic acid
11, 12	AlSi20 internal coating plasma-sprayed onto substrate Al (6060)	Insufficient contrast (hard phases are visible)	Contrast strengthened by ZnSe vaporisation (hard phases are less pronounced, but multi-phase matrix structure is easier to detect) - Note: on a black/white display much of the information regarding colour contrast is lost.
13, 14	AlSi6, arc Substrate: Al (6060)	Structural breakouts due to excessive polishing time	Stick to optimum polishing time
15, 16	CuAl10, HVOF Substrate: S235JR	Blurred structure and porosity due to excessive polishing pressure	Optimum structure development due to appropriate pressure

This publication has been drawn up by a group of experienced specialists working in an honorary capacity and its consideration as an important source of information is recommended. The user should always check to what extent the contents are applicable to his particular case and whether the version on hand is still valid. No liability can be accepted by the Deutscher Verband für Schweißen und verwandte Verfahren e.V., and those participating in the drawing up of the document.

DVS, Technical Comittee, Working Group „Thermal coating processes“

Orders to: DVS Media GmbH, P. O. Box 10 19 65, 40010 Düsseldorf, Germany, Phone: + 49 (0) 211/1591- 0, Telefax: + 49 (0) 211/1591- 150

Reprinting and copying, even in the form of excerpts, only with the consent of the publisher

Voransicht des Regelwerkes

Table 2. Preparation instructions.

Figure	Grinding (300 rpm) S: SiC wet D: diamond							Polish(150 rpm)					Contrast etching agent
	Par	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Par	Stage 1	Stage 2	Stage 3	Stage 4	
1 - 4	S	180	320	500	800	1200	–	D	6	3	1	OPS	
	D	–	–	–	–	–	–	T	KF	KF	KF	KT	
	Z	flat	1	1	1	1	–	Z	20	8	2	4	
	P	150	150	150	150	150	–	P	130	150	150	120	
5; 6	S	180	–	–	–	–	–	D	6	3	1	OPS	V2A pickling
	KD	–	15	–	–	–	–	T	HK	HS	KF	KT	
	Z	flat	4	–	–	–	–	Z	5	5	5	5	
	P	120	100	–	–	–	–	P	80	80	80	[illegible]	
7; 8	S	180	400	800	1200	–	–	D	3	1	OPS	–	
	D	–	–	–	–	–	–	T	HS	HS	KT	–	
	Z	3	3	1	1	–	–	Z	3	3	3	–	
	P	150	100 130	100	100	–	–	P	150	150	[illegible]		
9; 10	S	180	400	800	1200 +W	2400 +W	4000 +W	D	3	1	OPS	OPS+ NaOH	5%Mo (15s) Figure 10
	D	–	–	–	–	–	–	T	KF	KF	KT	KT	
	Z	1	1	1	1	1	1	Z	3	3	1	1	
	P	120	120	120	100	100	100	P	100	100	90	90	
11; 12	S	180	400	800	1200 +W	2400 +W	4000 +W	D	3	[illegible]	OPS	OPS+ NaOH	ZnSe-vaporised Figure 12
	D	–	–	–	–	–	–	T	KF	KF	KT	KT	
	Z	1	1	1	1	1	1	Z	3	3	1	1	
	P	120	120	120	100	100	100	P	100	100	90	90	
13	S	180	400	800	1200 +W	2400 +W	–	D	3	1	OPS	OPS+ NaOH	
	D	–	–	–	–	–	–	T	KF	KF	KT	KT	
	Z	1	1	1	1	1	–	Z	3	3	1	1	
	P	100	100	100	100	100	–	P	100	100	90	90	
14	S	180	400	800	1200 +W	2400 +W	4000 +W	D	3	1	OPS	OPS+ NaOH	
	D	–	–	–	–	–	–	T	KF	KF	KT	KT	
	Z	1	1	1	1	1	1	Z	2,5	2	1	1	
	P	120	120	120	100	100	100	P	100	100	90	90	
(15); 16	S	180	400	800	1200 +W	2400 +W	–	D	3	1	OPS	OPS+ NAOH	Specimen 15 prepared with excessive pressure
	D	–	–	–	–	–	–	T	KF	KF	KT	KT	
	Z	1	[illegible]	1	1	1	–	Z	3	3	1	1	
	P	100	100	100	100	100	–	P	90	90	80	80	

Key:
Par Parameter
T Fabric type
S Grind with SiC, wet; grain size in mesh
D Diamond grinding; grain size in mm

Voransicht des Regelwerkes