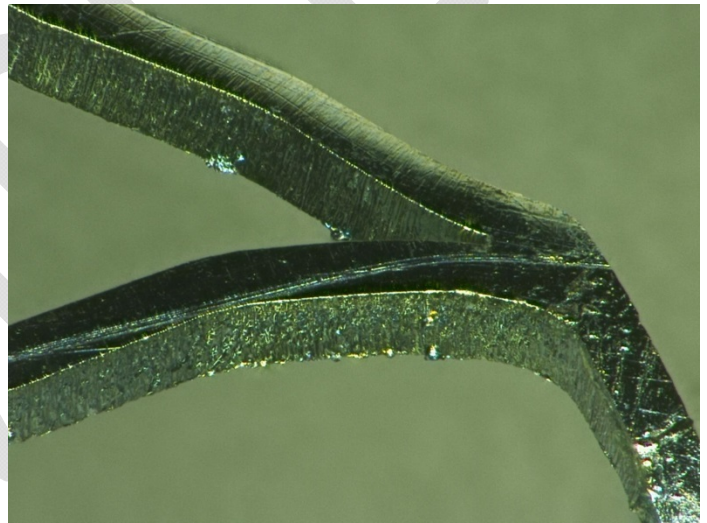
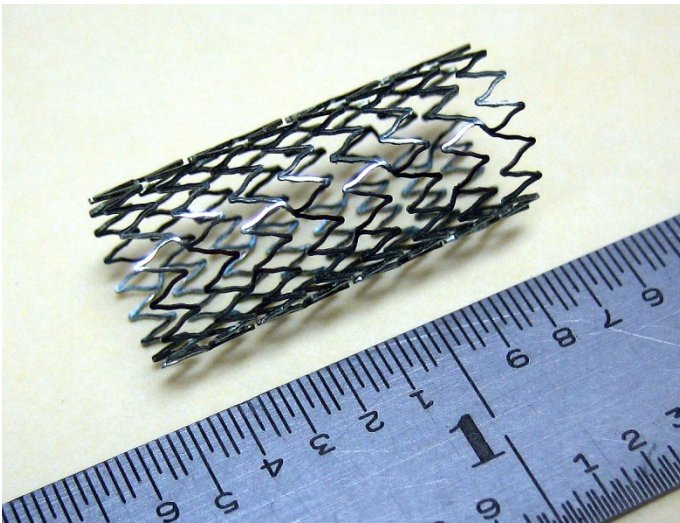


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Project Title: Stent cleaning
Completed: 08/013/2014
Completed by: Rob Berkuta

Overview: The COMCO Applications Lab received the following sample stents for oxide removal. The current process for removing all oxide from the stents is with an automated process, blasting from the OD only. A maximum weight of 5% can be removed from the stent during blasting. The primary objective is to remove only the oxide. The daily production rate is 180 stents/day.



Set-up and Procedure: The stents were treated using an abrasive lathe. The abrasive lathe is a semi-automated machine, controlling nozzle speed, position, part rotation, and blast parameters during blasting. Each stent was blasted first from the OD, then the ID. During OD blasting, the stent was supported on a mandrel (see picture below) while an array of 4 nozzles traveled over the stent at a consistent speed, blasting the stent. After OD blasting, the stent was installed in an ID mandrel, and an ID nozzle traveled through the axis of the stent to remove the remainder of the oxide. Blast parameters (pressure, powder, nozzle size, etc.) were chosen based on COMCO's experience with similar processes. All blast parameters including processing time/stent are listed below.

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Sample Results:

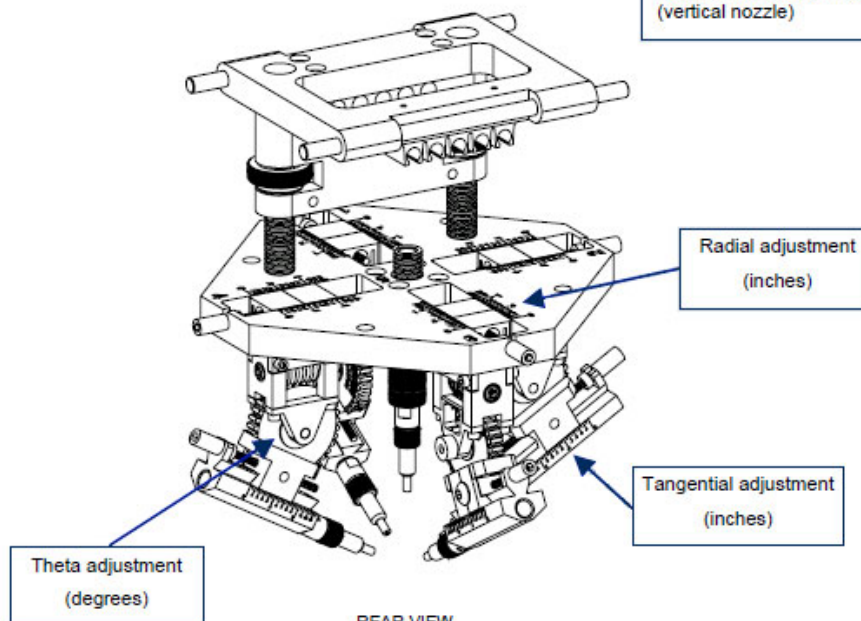
All test samples were processed using these parameters:

Configuration	Lathe Settings	
Samples	1-5	10, 11
Spindle RPM	60	60
Nozzle Speed	0.06	0.06
Cycles	1	1
Blast Pressure (static – measured while not blasting)	25 psi	25 psi
Abrasive powder	17.5 micron aluminum oxide	17.5 micron aluminum oxide
Tank Orifice	.030	.030
Powder Flow Adjustment	Full powder	Full powder
OD blast nozzle	4 x MB1520-29	4 x MB1520-29
ID blast nozzle	1 x MB1506-2	1 x MB1506-2
Total blast time/stent (OD and ID blast), (min:sec)	5:35	5:35

OD Head Configuration	Nozzle	Theta Adjustment	Tangential adjustment	Radial adjustment	Head z adjustment
	1	25	0.5	0.10	.8
	2	30	0.9	0.91	
	3	25	0.5	0.10	
	4	30	0.9	0.75	
	5	Not used			

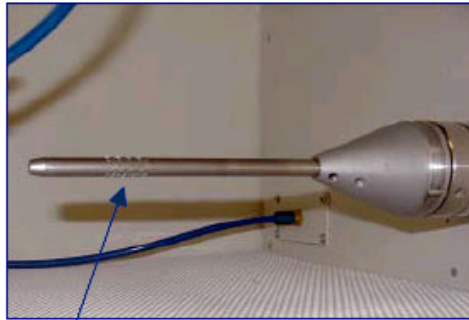
OD nozzle head

Nozzle Numbering: 1-5, numbered clockwise, starting at front nozzle. Nozzle # 5 located in center (vertical nozzle)

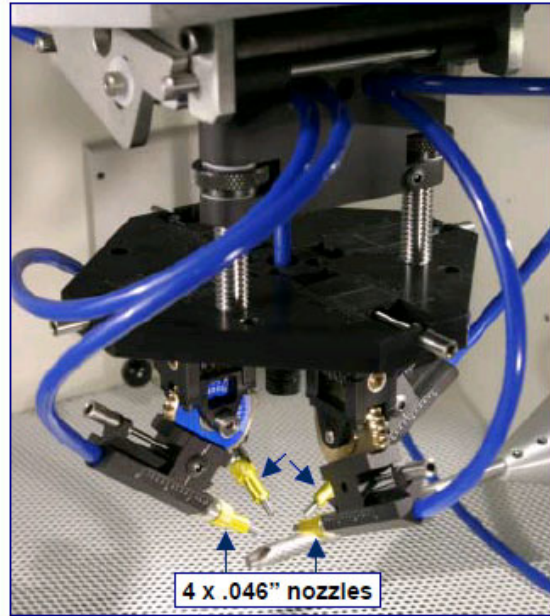


REAR VIEW
SOME PARTS REMOVED
FOR CLARITY

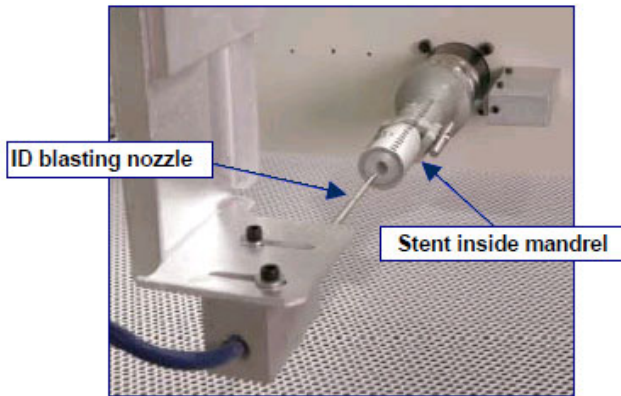
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Stent loaded in lathe for OD blasting: supported by mandrel, ready to be blasted.



Engineering OD blast head



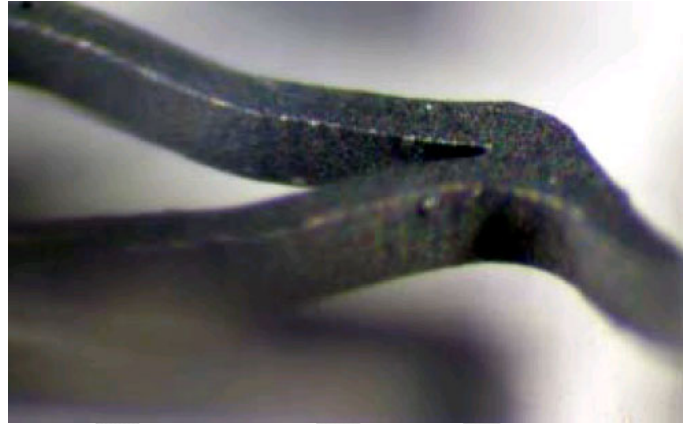
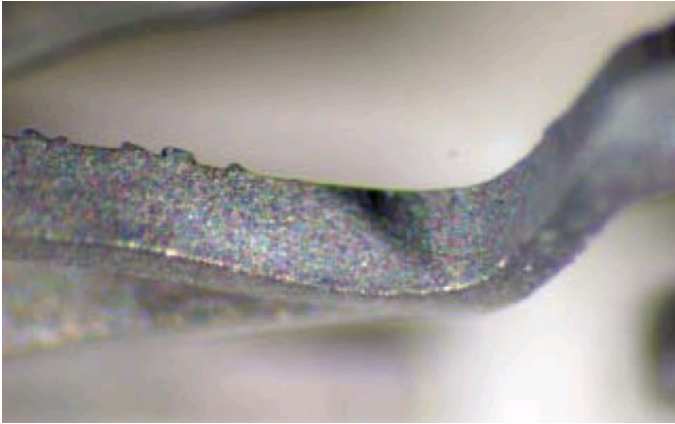
ID blasting

Test Parameters and Results: Listed below are the before and after weights of the stents. Stents 1-5 are within the 5% limit of material removal. All oxide was removed from these stents. These samples (1-5) were blasted at a relatively low pressure (25 psi) and still have remnants of pulse lines as well as sharp edges. Comco processed two additional samples (10, 11) at a higher pressure (70 psi) in order to remove the pulse lines and radius the edges. As shown with samples 10 and 11, it is possible to achieve a relatively smooth surface finish; but will require greater than 10% material removal. If only the oxide is to be removed as originally requested, the material removal rate will remain below 5%.

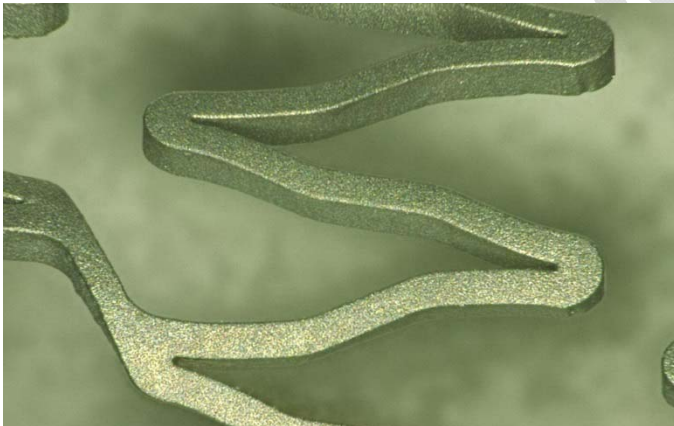
Amount of Material Removed from Stents

Sample	Start Wt. (g)	End Wt. (g)	% removed
1	0.164	0.156	4.9%
2	0.164	0.156	4.9%
3	0.165	0.157	4.8%
4	0.164	0.156	4.9%
5	0.165	0.157	4.8%
10 (blasted at 70 psi)	0.161	0.128	20.5%
11 (blasted at 70 psi)	0.164	0.134	18.3%

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Surface finish of samples 1-5. Oxide removed. Some sharp edges and pulse lines on walls are still present.



Surface finish of samples 10 & 11 (blasted at higher psi). Edges are radiused, majority of pulse lines removed.

Conclusion: Comco processed 7 stents for evaluation. Five of the stents were blasted at 25 psi. These stents were fully cleaned and had material removal of less than 5%. Comco also processed 2 additional stents, in order to remove the pulse lines and radius the edges. These stents were blasted at 70 psi and had substantially more material removed. The treated stents have been cleaned with air only and may have residual abrasive on them.