Bristle Blasting of Ship-Construction Steel and Welded Joints

A Summary of NACE Paper no. 10385, 11417 and C2012-0001442, Lukas Janotta, M.Sc. RWTH

This document summarizes three scientific papers written by Prof. Robert J. Stango and Prof. Raymond A. Fournelle which were published by NACE International, dealing with the impact of the Bristle Blasting technology on commonly used ship-construction steel ABS-A as well as their weld joints.

The commercial ship building industry requires the same aspects as other major industries (e.g., pipeline construction) when it comes to surface preparation, especially close to and on weld seams. Therefore, investigations have been carried out about cleanliness, roughness, and material removal in these areas.

Bristle blasted surfaces are uniform, free of corrosion, and without corroded pits after cleaning ABS-A specimen with an initial rust grade D. High magnifying scanning electron microscopic (SEM) images confirm as well as emphasize the characteristic impact crater with repeated shovel micro-indentations.[1, 2]

By considering the generated anchor profile R_z (up to 105 µm) including the cleanliness obtained, the Bristle Blasting process surpasses all other power tool cleaning processes and rather appears to be comparable to near-white blast (SP 10) or even white metal blast cleaning (SP 5).[2]

Despite the fact that each bristle tip strikes the surface in an impulsive motion manner, therefore, having an extremely short contact time (less than a second), long term material extraction tests have been conducted on parent material and the weld seam. Figure 1 illustrates similar material removal rates regardless their average Vickers hardness (parent material 155 HV vs. weld 194 HV) and the tool age.[3, 4] By analyzing different penetration depths to simulate the operator's applied force, the authors were able to determine the greatest material removal at the deepest penetration depth as well as decrease of extraction along the tool life (Figure 2)[5].

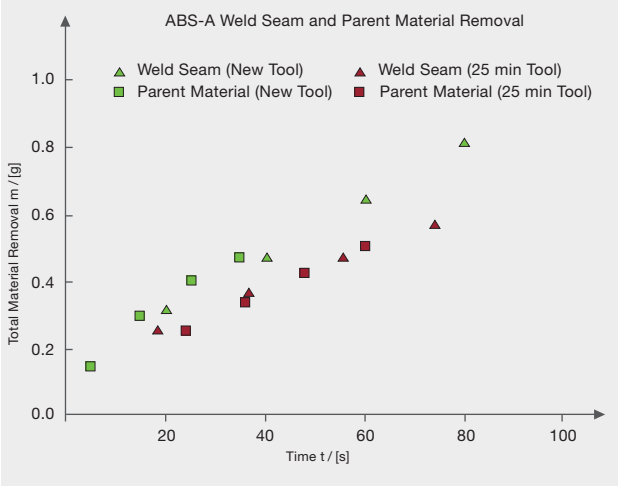

Figure 1: Weld Seam and Parent Material Removal of ABS-A for Different Tool Ages[3]

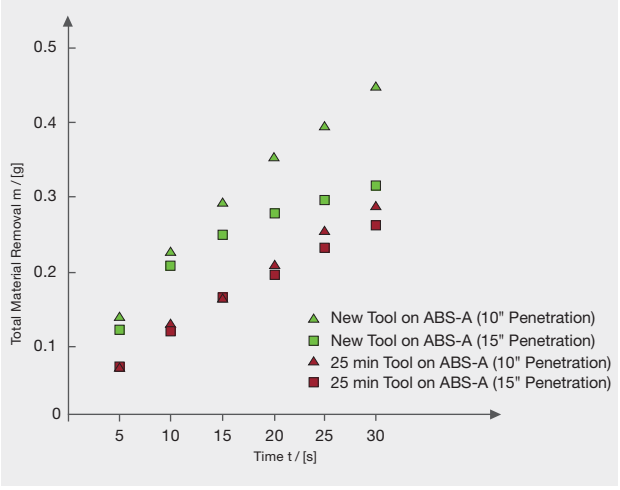

Figure 2: Material Removal of ABS-A for Different Tool Ages and Penetration Depths[5, 6]

In contrast to material extraction, roughness parameters do not significantly differ relative to the penetration depth (Figure 3). Taking the ordinary operating force (Figure 4) into account, one may conclude that it is unnecessary to apply high forces in order to achieve a high level of cleanliness and roughness, giving the bristle tips a longer service life.

Key Facts

- Cleanliness comparable to Sa 2½ (SP 10) or even Sa 3 (SP 5)
- Roughness R_z up to 105 µm along tool life cycle
- Applied force comparable to machine weight

References: [1] Stango, R.J. and Fournelle, R.A., "Surface Preparation of Ship-Construction Steel/(ABS-A) via Bristle Blasting Process". In NACE Corrosion Conference 2010, San Antonio, Paper no. 10385, p. 10 | [2] Ibid., p. 11 | [3] Stango, R.J. and Fournelle, R.A., "Bristle Blast Surface Treatment of Welded Joints Fabricated from Commercial Ship Construction Steel". In NACE Corrosion Conference 2011, Houston, Paper no. 11417, p. 12 | [4] Ibid., p. 9 | [5] Stango, R.J. and Kargol, E., "Evaluation of Bristle Blasting Process for Surface Preparation of Ship-Construction Steel". In NACE Corrosion Conference 2012, Salt Lake City, Paper no. C2012-0001442, p. 8 | [6] Ibid., p. 7 | [7] Ibid., p. 9 | [8] Ibid., p. 6

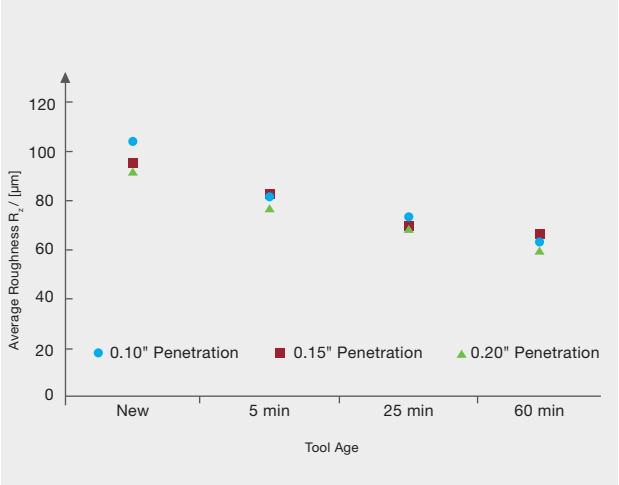

Figure 3: Roughness Parameter R_z as the Tool Progressively Ages [7]

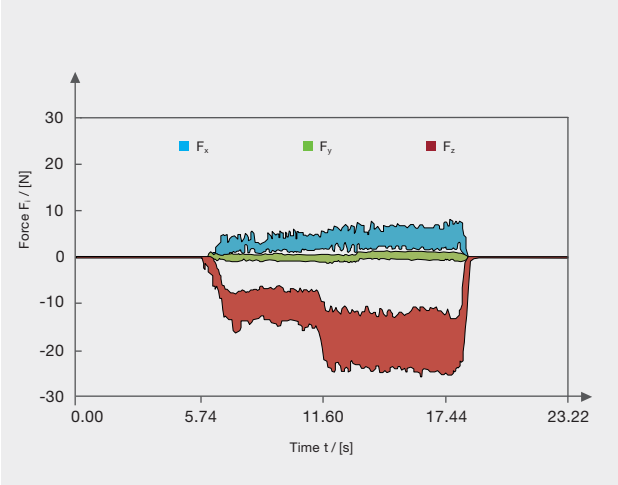

Figure 4: Ordinary Force (First Plateau) and Heavy Force Exertion (Second Plateau) during Bristle Blasting Process [6]

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