Closure to "Discussion of 'Experimental Investigation of Fully Plastic Contact of a Sphere Against a Hard Flat' " (2007, ASME J. Tribol., 129, p. 700)

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The authors thank the reviewers' (Dr. Jackson and Dr. Green) interest in the paper arising several issues for discussion. We agree with the reviewers that even in the fully plastic regime there will be some elastic recovery. However, this elastic recovery is very small (relatively) compared to the total deformation, which in turn, the effect to the contact area is very small as well. The measurement method used has a lateral resolution of 1 μm or about 0.1% of the measured plastic contact area. We have been investigating the effect of the roughness to the contact area and mean contact pressure, see [1]. We concluded that in our experiments the effect of the roughness is negligible.

We assume that no strain hardening occurred in our experiments. This assumption is based on hardness tests performed. A small increase in the hardness value of 1.15 to 1.2 GPa for copper was measured in the plastic contact area. Due to this small deviation we can say that there is almost no change in hardness value. Similar hardness tests were preformed for the aluminum specimen. For aluminum, the deviation is even smaller, from 0.277 to 0.28 GPa.

For the S_y value for the JG model, we use the $H=2.8S_y$ relation. When we use $H=3S_y$ the deviation of the JG model to the experimental results is even more pronounced. Nevertheless, whatever S_y value used in the JG model, the JG model will show almost no constant mean contact pressure.

For measuring the interference, first we measure the virgin sphere (before any load applied) for about 2 mm length of curvature. From this result we fit the data using the "known" radius of the sphere. It appears that there is no difference between the fitted data and the measured data. Therefore, we used this method to calculate the interference for the deformed sphere. It should be noticed here that for the deformed sphere, extra data of the undeformed part of the sphere must be taken to be used for the reference of both the deformed profile and the undeformed profile. Since we use the above-mentioned method there is no bias to the AF model.

As a conclusion we say that what all we gained from the experiments performed just confirm the preceding studies such as described in Refs. [17] and [18] of Ref. [2]. The JG model and Ref. [9] of Ref. [2] are important but for the working area of the contact of engineering surfaces, the finite deformation regime where the mean contact pressure decreases is less important. Before the asperity goes to the finite deformation regime the neighboring asperities will support the applied load.

References

[1] Jamari, J., and Schipper, D. J., 2007, "Deformation Due to Contact Between a Rough Surface and a Smooth Ball," Wear, **262**(1-2), pp. 138–145.
[2] Jamari, J., and Schipper, D. J., 2006, "Experimental Investigation of Fully Plastic Contact of a Sphere Against a Hard Flat," ASME J. Tribol., **128**, pp. 230–235.

