Supplementary Data for

"Possible electronic entropy-driven mechanism for non-thermal ablation of metals"

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Here, a method of the determination of the local reflectivities $R_n^L(J)$ as a function of laser fluence $J$ is explained. In a previous experiment,$^1$ total reflectivity $R_n^T(J_0)$ was observed by irradiation with a laser whose peak fluence is $J_0$. $R_n^T(J_0)$ is calculated with $R_n^L(J)$ and the space distribution of the laser fluence $J(r)$:

$$R_n^T(J_0) = \frac{\int_0^{2\pi} \int_0^{\infty} J(r) R_n^L(J(r)) r d\theta dr}{\int_0^{2\pi} \int_0^{\infty} J(r) r d\theta dr} \quad (s1)$$

Here $r$ is the distance from the center of the laser spot. To obtain $R_n^L(J)$ from $R_n^T(J_0)$, we make assumptions that the space distribution of laser fluence is the Gaussian distribution and $R_n^L(J)$ can be described as:

$$R_n^L(J) = a_n \ln J + b_n, \quad (s2)$$

where $a_n$ and $b_n$ are constant parameters. The latter assumption is justified around or somewhat above ablation threshold by a previous model calculation.$^2$ From Eqs. (s1) and (s2),

$$R_n^T(J_0) = a_n \ln J_0 + a_n \left( \frac{1}{2} \ln \frac{\beta}{\pi} - 1 \right) + b_n \quad (s3)$$

can be derived. By fitting the experimental$^1$ reflectivities $R_n^T(J_0)$ with Eq. (s3), $a_n$ and $b_n$ are obtained. As a result, $R_n^L(J_0)$ is determined, of which the root mean square errors were less than 0.02. In our simulation, these $a_n$ and $b_n$ were used to simulate the ablation depth.

REFERENCES

$^1$A. Y. Vorobyev and C. Guo, J. Appl. Phys. 110, 043102 (2011).

$^2$Y. P. Ren, J. K. Chen, and Y. W. Zhang, J. Appl. Phys. 110, 113102 (2011).