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Dominique Barchiesi
Thomas Grosges
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Dominique Barchiesi* and Thomas Grosges
Institut National de Recherche en Informatique et Automatisme (INRIA), University of Technology of Troyes (UTT), Automatic Mesh Generation and Advanced Methods (GAMMA3), 12 rue Marie Curie, CS 42060, 10004 TROYES CEDEX

Abstract. This paper [J. Nanophoton. 8(1), 083097 (2014)] was published on 6 January 2014. Thanks to a question by Yoann Brûlé from the Fresnel institute (Marseille, France), we found that the values of $\gamma_L$ and $\gamma_D$ were swapped in tables in Ref. 1. The problem comes from a bug in the automatic extraction of data from optimization method. Fortunately the curves in Ref. 1 are correct. This erratum gives a more readily available formulation of fitting for all considered metals and the corresponding criteria. © 2014 Society of Photo-Optical Instrumentation Engineers (SPIE) [DOI: 10.1117/1.JNP.8.089996]

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1 The Combination of Drude and Lorentz Models

The function of fit $\varepsilon_{DL}(\omega)$ of the relative permittivity of metal is written as the sum of the Drude and the Lorentz models:

$$\varepsilon_{DL}(\omega) = \varepsilon_\infty - \frac{\omega_D^2}{\omega(\omega + i\gamma_D)} - \frac{\Delta\varepsilon\omega_L^2}{\omega^2 - \omega_L^2 + i\gamma_L\omega}.$$  

(1)

In the following the angular frequency $\omega$ (rad/s) that is used in formula falls within the visible domain [2.354e15; 4.709e15] rad/s, corresponding to wavelengths in [400; 800] nm and photon energy in [1.55, 3.10] eV. Outside this domain, the quality of fitting can be impaired. This erratum gives us the opportunity to give better solutions to this hard problem of fitting, by investigating a wider space of search. The values of $\sigma_R$ and $\sigma_I$ are calculated according formula (8-9) in¹, including the number of data used to compute the fitting equation.

1.1 Gold (Johnson & Christy²)

$$\varepsilon_{DL}^{\text{JC}}(\omega) = 6.1599 - \frac{1.8160E32}{\omega^2 + 17.2096E13\omega} - \frac{4.5011E31}{\omega^2 - 2.1732E31 + i1.6694E15\omega},$$  

(2)

$$C = 0.99995, \quad F = 0.55, \quad \sigma_R = 0.40, \quad \sigma_I = 0.38.$$  

1.2 Gold (Palik³)

$$\varepsilon_{DL}^{\text{Palik}}(\omega) = 0.6888 - \frac{1.5817E33}{\omega^2 + 17.3731E15\omega} + \frac{9.3582E32}{\omega^2 - 5.5354E30 + i4.9327E15\omega},$$  

(3)

$$C = 0.24646, \quad F = 1.08, \quad \sigma_R = 0.95, \quad \sigma_I = 0.51.$$  

*Address all correspondence to: Prof. D. Barchiesi, E-mail: dominique.barchiesi@utt.fr
1.3 Silver (Palik$^3$)

\[ \epsilon_{DL}^{Ag}(\omega) = \frac{0.0067526 - 1.7584E32}{\omega^2 + i1.0444E14\omega} - \frac{9.9267E32}{\omega^2 - 2.6509E32 + i7.3068E15\omega}, \]  

\[ C = 0.80656, \quad F = 0.07154, \quad \sigma_R = 0.053, \quad \sigma_I = 0.048. \]

1.4 Aluminum (Palik$^3$)

\[ \epsilon_{DL}^{Al}(\omega) = \frac{0.13313 - 9.0588E32}{\omega^2 + i3.1083E15\omega} + \frac{5.6526E32}{\omega^2 - 1.2718E31 + i6.4539E15\omega}, \]  

\[ C = 0.996, \quad F = 2.98, \quad \sigma_R = 2.49, \quad \sigma_I = 1.64. \]

1.5 Chromium (Palik$^3$)

\[ \epsilon_{DL}^{Cr}(\omega) = \frac{2.7767 - 2.5306E32}{\omega^2 + i2.9966E15\omega} - \frac{1.4736E32}{\omega^2 - 1.1087E31 + i2.5764E15\omega}, \]  

\[ C = 0.9998, \quad F = 0.947, \quad \sigma_R = 0.63, \quad \sigma_I = 0.71. \]

1.6 Titanium (Palik$^3$)

\[ \epsilon_{DL}(\omega) = -5.4742E7 - \frac{3.4555E32}{\omega^2 + i5.1502E15\omega} - \frac{9.3068E54}{\omega^2 - 1.7001E47 + i3.2120E24\omega}, \]  

\[ C = 0.9665, \quad F = 0.57, \quad \sigma_R = 0.47, \quad \sigma_I = 0.33. \]

2 Conclusion

The proposed results of fitting of relative permittivities of metals are more accurate than those proposed in a previous paper$^4$ and verify the criterion of compatibility with FDTD use. They can be used directly for any spectroscopic simulation$^5,6$ and especially in FDTD codes, and for plasmonics$^7$ and optimization where accurate positions of resonances should be found. The proposed method of fitting under constraint is a combination of PSO and Nelder-mead simplex methods appears to be efficient, even if the solution of the problem of fitting is not unique.

References

