WAVE NATURE OF DEUTERIUM FLUX PERMEATING THROUGH PALLADIUM THIN FILM WITH NANOMETER COATING LAYERS --- (II) THEORETICAL MODELING

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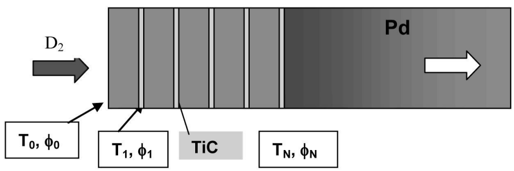
Super-wave has generated the long lasting, high gain "excess heat" in deuterium/palladium systems during Energetics Technologies, ENEA, and SRI collaboration. There must be an internal wave nature of the deuterium/palladium systems, which is in response to external super-wave, particularly, near the surface of the deuterium/palladium systems. Three sets of experimental data in the past 7 years at Tsinghua University are summarized to reveal this wave nature (please see abstract (I)). A simple theoretical model was set-up to understand this wave nature.



In the picture each interface is described by two parameters, the transmission rate (T), and the change of the phase angle (ϕ). Based on the matrix algebra, we may reach 3 conclusions:

(1) The tansmission rate of the palladium coated with nanometer TiC-Pd layers is

$$T_N = \left| \frac{Sin\alpha_1}{\sqrt{\frac{1}{T_1}} e^{i\phi_1} Sin(N\alpha_1) - Sin[(N-1)\alpha_1]} \right|^2$$

$$\phi_N = Arg[(\sqrt{\frac{1}{T_1}} e^{i\phi_1} Sin(N\alpha_1) - Sin[(N-1)\alpha_1]) / Sin\alpha_1]; \qquad \alpha_1 = ArcCos[\sqrt{\frac{1}{T_1}} Cos\phi_1].$$

Here, N is the number of nanometer coating layers. Using 4 input parameters, T_0, ϕ_0, T_1, ϕ_1, it reproduces the experimental data. Here (T_0, ϕ_0) describes the interface between deuterium and palladium. (T_1, ϕ_1) describes the interface of Pd-TiC-Pd.

(2) An identity is derived to show the correlation between deuterium flux and the "excess heat" :

$$\frac{A_{0N}}{T_{0N}} = \frac{A_0}{T_0} + \frac{A_N}{T_N} + \frac{A_0}{T_0} * \frac{A_N}{T_N}.$$

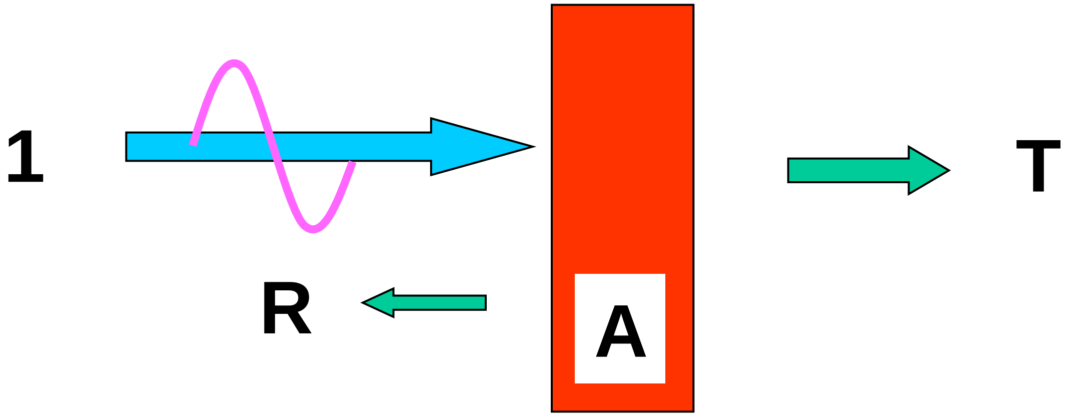
Here, (A_0) describes the absorption in the interface between deuterium and palladium, and (A_N) describes the absorption in the N-Layers of Pd-TiC-Pd coating. (A_{0N}) describes the absorption in the combination of the interface between deuterium and palladium and the N-Layers of Pd-TiC-Pd coating. This identity shows the effect of multiple scattering among those interfaces.

(3) Super-wave may affect the surface parameters ϕ_0, ϕ_1 ; then, it changes the deuterium flux which permeating through the palladium film with multiple coating layers, T_{0N} . Thus it will enhance the "excess heat" (A_{0N}).

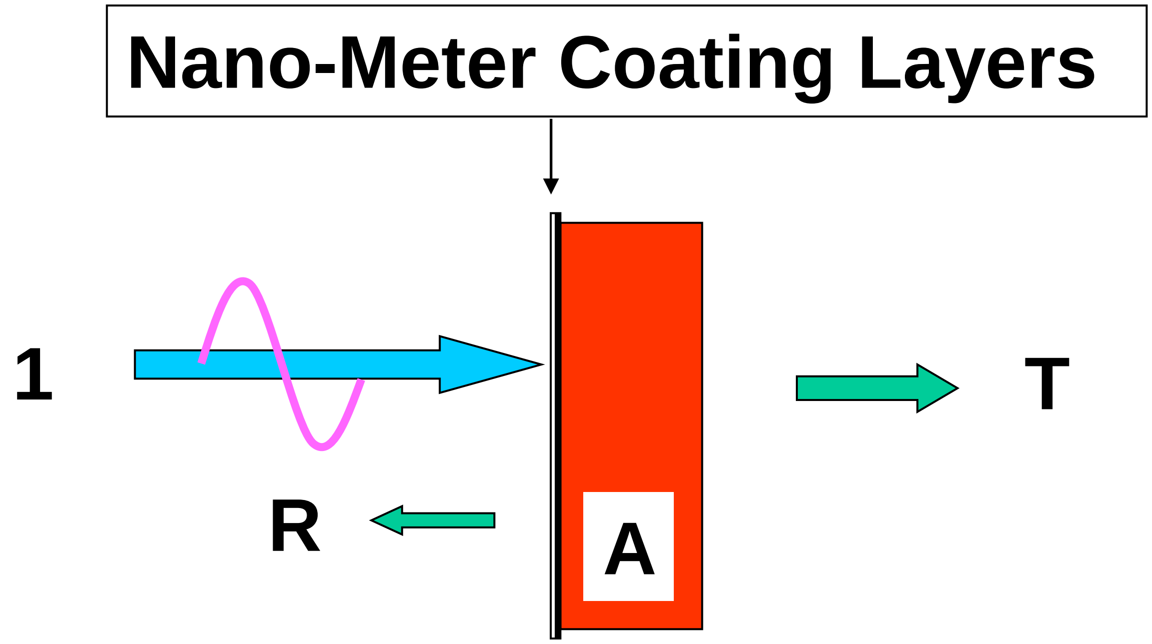
Wave Nature of Deuterium Flux Permeating through Palladium Thin Film with Nanometer Coating Layers --- (ＩＩ) Theoretical Model ----

Correlation (Flux & Heat)

$$1 - R = A + T$$



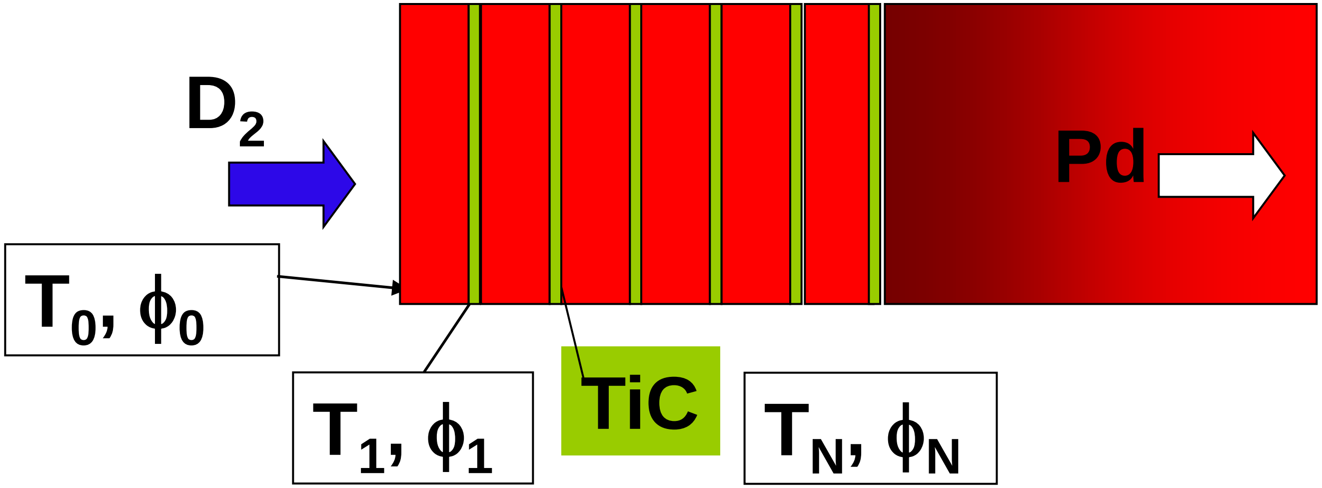
$$\left(\frac{A}{T}\right)$$



Wave Model Identity

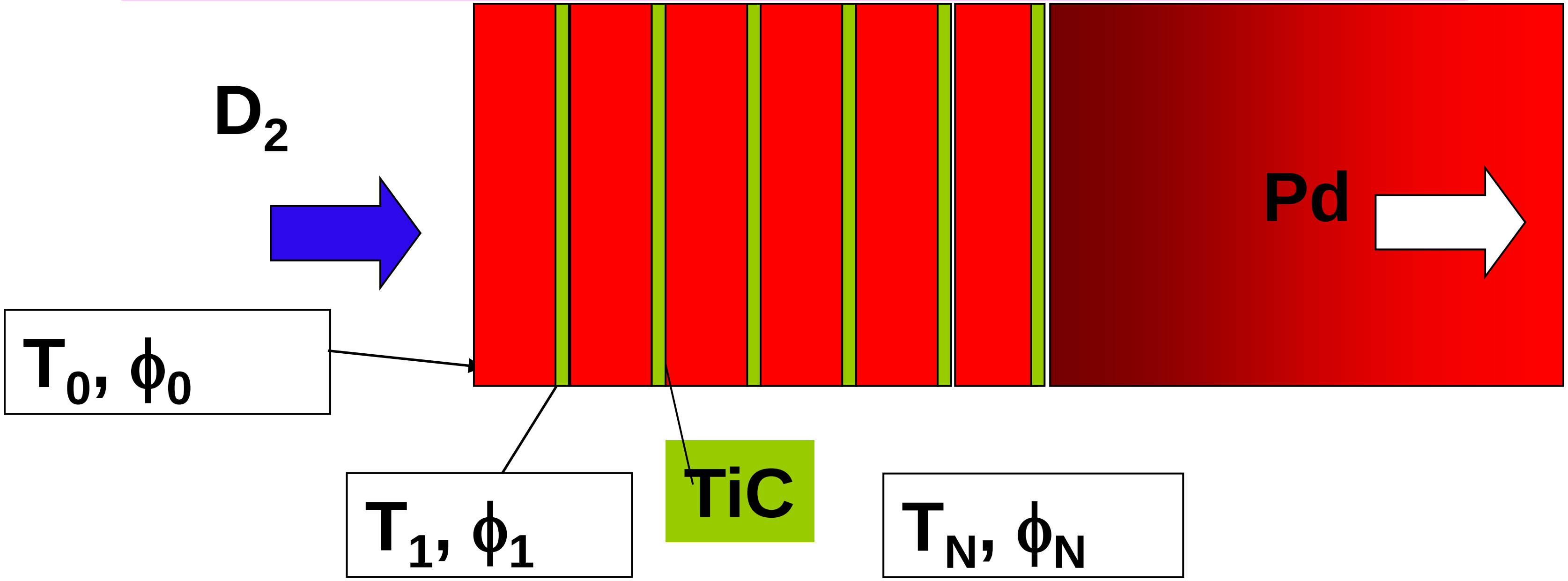
$$\frac{A_{0N}}{T_{0N}} = \frac{A_0}{T_0} + \frac{A_N}{T_N} + \frac{A_0}{T_0} * \frac{A_N}{T_N}$$

Multiple Nano-Meter Coating Layer



$$T_{0N} = \frac{T_0 * T_N}{T_0 * T_N + (\sqrt{1-T_0} - \sqrt{1-T_N})^2 + 4\sqrt{(1-T_0)(1-T_N)}(Cos[\frac{\phi_0 + \phi_N}{2}])^2}$$

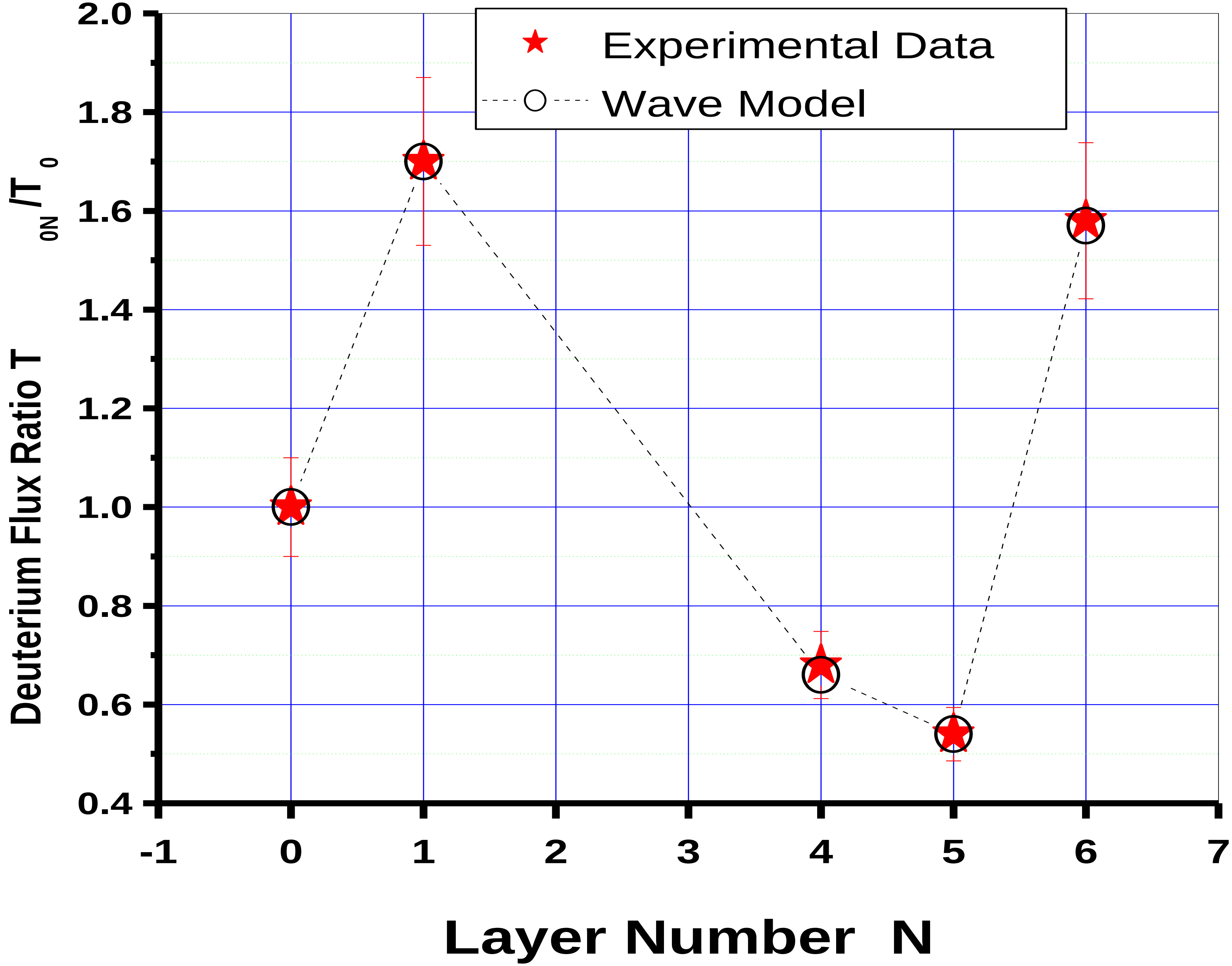
High Deuterium Flux with High Loading



❖ **High Flux with Coating Layer Build-up High Loading Surface (Iwamura super lattice)**

❖ **Super Wave may affect Phase ϕ_0 & ϕ_1 → High Flux (T_{0N})**

❖ **High Flux (T0N) Introduces More Absorption (A0N) in Surface Layers (Correlation btn Flux & Heat)**



Experimental Data
Wave Model
Deuterium Flux Ratio T_{0N}/T_0
Layer Number N
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
-1
0
1
2
3
4
5
6
7