Optical and Electrochemical Characterization of Nanoporous Alumina Structures: Pore Size, Porosity, and Structure Effect

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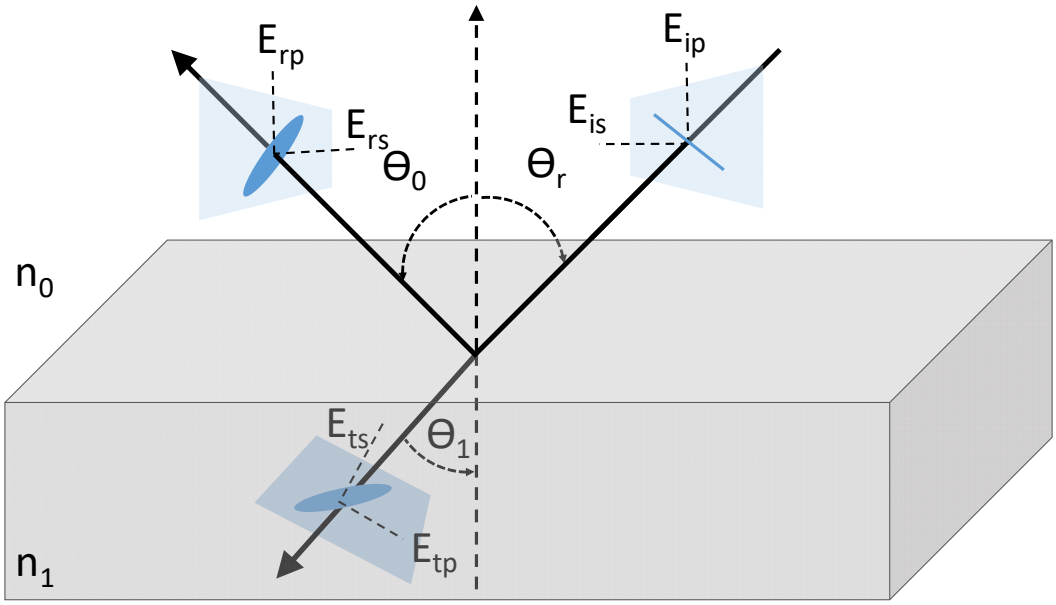

Figure S1. Scheme of spectroscopy ellipsometry measurement for a homogeneous sample.

Ellipsometry measured angles Ψ and Δ are related to the ratio of Fresnel reflection coefficients $\tilde{R}_p$ and $\tilde{R}_s$ (p for parallel and s for perpendicular polarized light) by:

$$\rho = \frac{\tilde{r}_p}{\tilde{r}_s} = \tan\Psi\, e^{i\Delta} \tag{1}$$

Fresnell expresions:

$$\tilde{r}_p = \frac{\tilde{E}_{rp}}{\tilde{E}_{ip}} = \frac{\tilde{n}_1 \cos\theta_0 - \tilde{n}_0 \cos\theta_1}{\tilde{n}_1 \cos\theta_0 + \tilde{n}_0 \cos\theta_1} \tag{2}$$

$$\tilde{r}_s = \frac{\tilde{E}_{rs}}{\tilde{E}_{is}} = \frac{\tilde{n}_0 \cos\theta_0 - \tilde{n}_1 \cos\theta_1}{\tilde{n}_0 \cos\theta_0 + \tilde{n}_1 \cos\theta_1} \tag{3}$$

Where $\tilde{E}$ is the incident electric field while the subscripts are: s for perpendicular, p for parallel, 0 for incident and 2 for transmitted. $\tilde{n}$ is the complex refraction index of: 0 the incident medium (usually vacuum or air), and 1 the bulk sample.
θ_0 , θ_r and θ_1 must fulfil two conditions:
- Specular reflection: $\theta_0 = \theta_r$
- The Snell's law has to be valid: $\tilde{n}_0 \cdot \sin\theta_0 = \tilde{n}_1 \cdot \sin\theta_1$

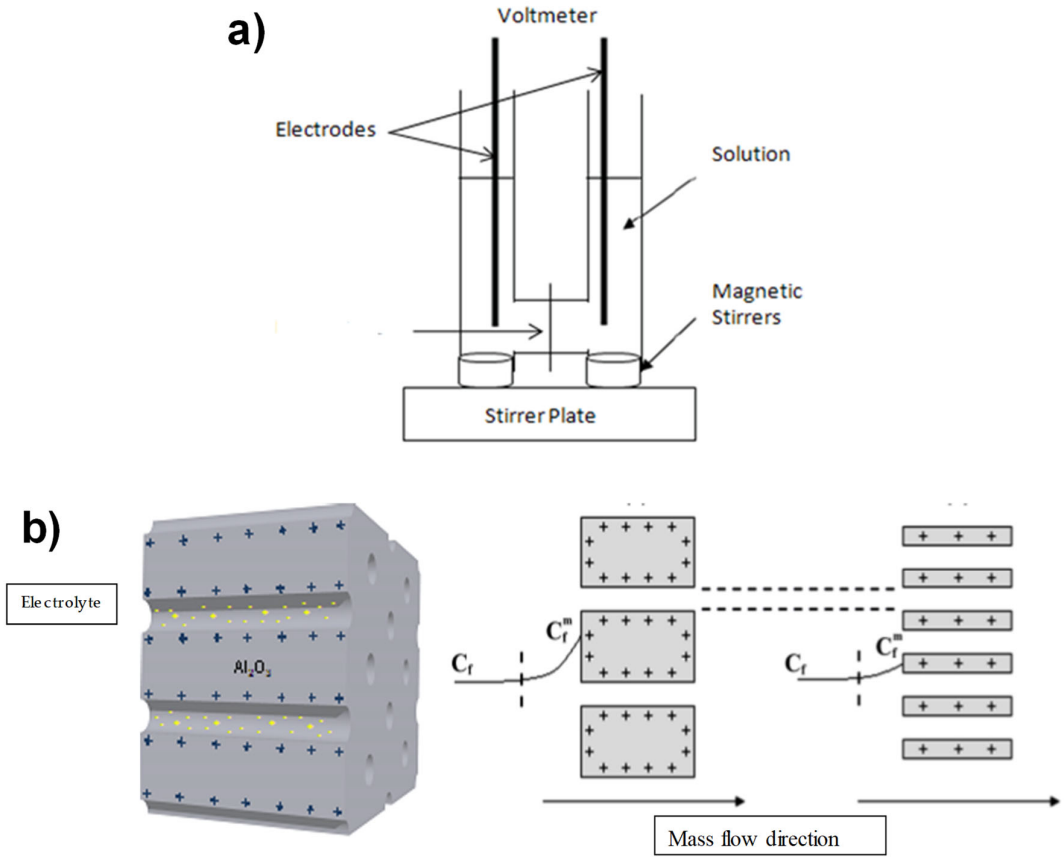

Figure S2. Scheme of: a) electrochemical test-cell; b) solid sample/electrolyte electrical distribution and interfacial effects.

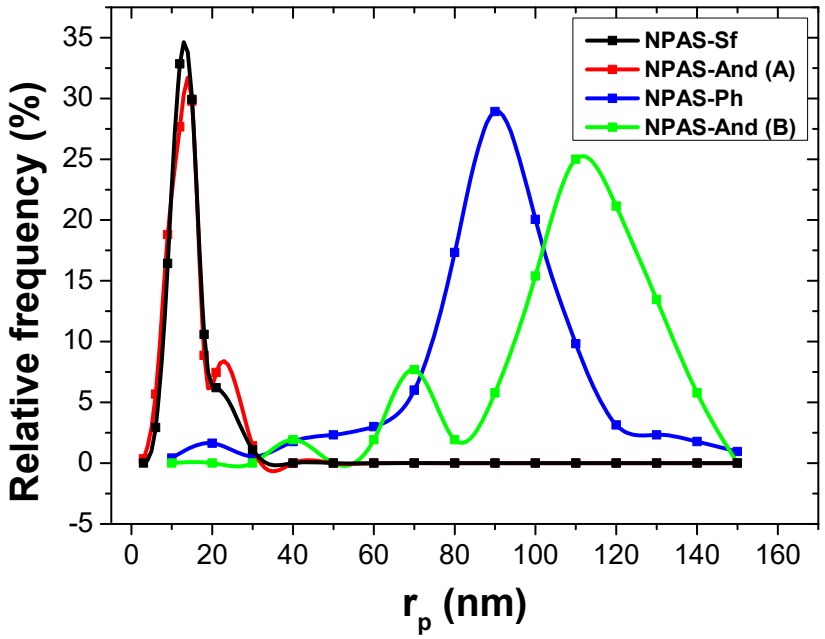

Figure S3. Analysis of the pore radii distribution for the studied samples.

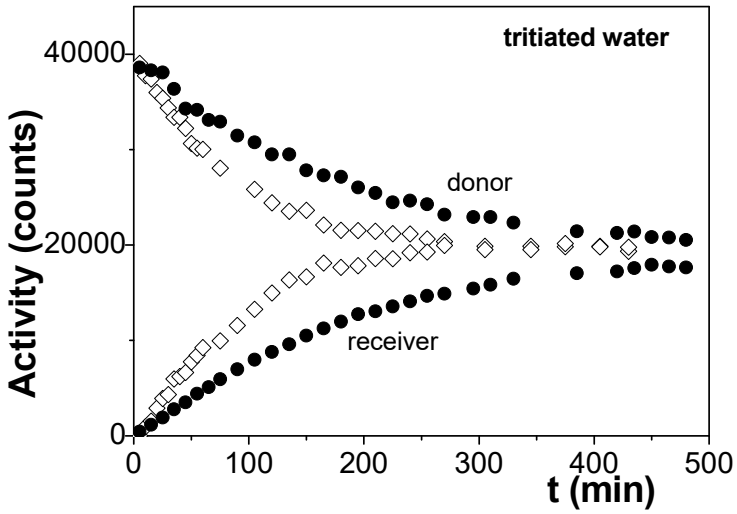

Figure S4. Time evolution of tritiated water activity in donor and receiver solutions for: (●) NPAS-Sf and NPAS-And (◊).