Supporting information

High Energy Ion Irradiation Induced Ordered Macropores in Zeolite Crystals

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Activity gain model

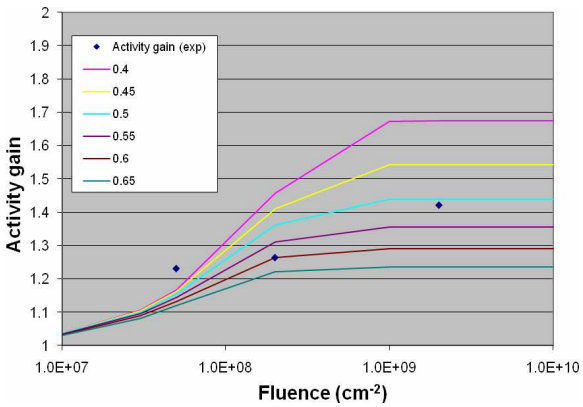
The final formulas employed in the activity gain model are provided below. Details of the calculations will be provided if necessary.

$\alpha = specific\ activity$
$r = radius\ of\ the\ pores$
$a = thickness\ of\ the\ active\ layer$
$A = volume\ of\ the\ active\ fraction$
$V = total\ volume$
$G = gain\ of\ activity$
$\Phi = fluence$
$S_0 = initial\ surface\ of\ the\ crystallite$
$S_p = internal\ surface\ of\ the\ pores$
$G_s = gain\ of\ surface$

$$\delta = a/r$$
$$P_n = \pi r^2 \Phi$$
$$P_\delta = P_n (1+\delta)^2$$
$$\alpha = A/V$$

$$G = \frac{\alpha_0}{\alpha_\Phi}$$
$$G = \frac{A_0/V_0}{A_\Phi/V_\Phi}$$
$$G = V_0/A_0 + (1 - V_0/A_0)\exp(P_n - P_\delta)$$

$$S_{p,\Phi} = V_0 \exp(-P_n)\, 2\, P_n / r$$
$$G_s \approx (S_0 \exp(-P_n) + S_{p,\Phi})/S_0$$



Figuer 1. Gain in activity is a function of the fluence and the size of secondary pore network. The expereimental points (rhombus), provided in Figure 5 in the main body of the article, are included.

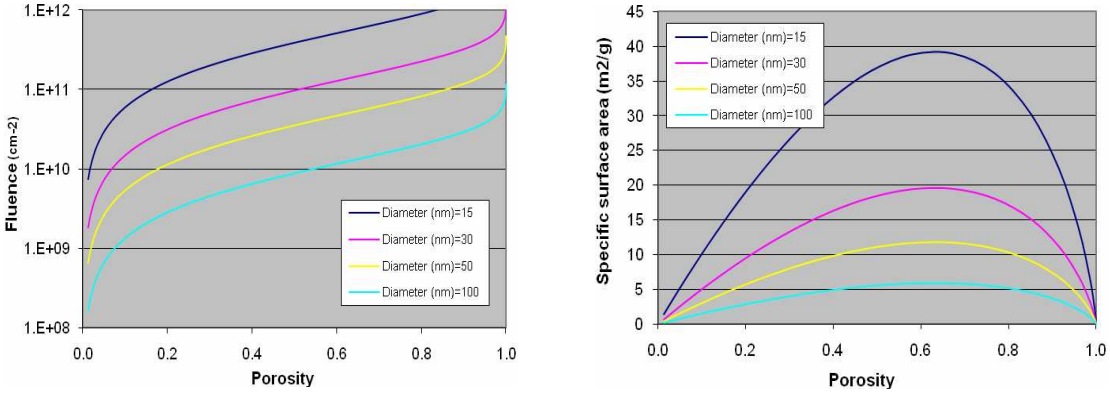


Figure 2. Increase of the external surface due to the introduction of secondary pore network in zeolite crystals. Left: Fluence rate – porosity relationship; Right: Increase of the external surface area as a function of the pore size.