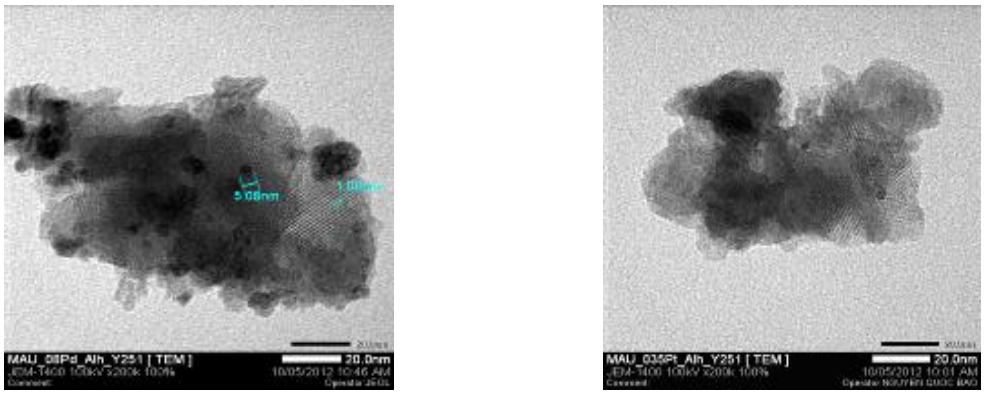

a) Pd/Al-HY (2.5:1) b)Pt/Al-HY(2.5:1)

Figure 3. TEM imagesof catalysts

**Table 1. Surface Area ($S_{BET}$); Crystallite Size of HY Calculatedat $2\theta = 6.5°$ ($d_{HY}$); Cluster Size of Pd, Pt ($d_{clu}$) and Metal Dispersity ($\gamma$)Determined by HPC, and Elemental Composition Determined by EDS**

| Catalyst | $S_{BET}$ ($m^2/g$) | $d_{HY}$ (nm) | $d_{clu}$ (nm) | $\gamma$ (%) | Elemental Composition(atom%) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | O | Al | Si | Pd |
| Pd/Al | 218 | - | 25.0 | 4.46 | 26.00 | 60.60 | 0.00 | 13.40 |
| Pd/HY | 409 | 33.1 | 7.3 | 15.95 | 33.90 | 16.85 | 48.03 | 1.24 |
| Pd/Al-HY(3:1) | - | 33.6 | 6.2 | 18.69 | - | - | - | - |
| Pd/Al-HY(2.5:1) | 285 | 34.1 | 6.1<br>5.08* | 18.80 | 22.98 | 75.69 | 1.33 | 0.00 |
| | | | | | 25.70 | 59.60 | 14.0 | 0.73 |
| | | | | | 27.20 | 36.50 | 33.3 | 2.98 |
| Pd/Al-HY(1:1) | 322 | 27.8 | 4.4 | 26.10 | - | - | - | - |
| Pd/Al-HY(1:2) | - | - | 4.2 | 27.57 | - | - | - | - |
| Pt/Al-HY(2.5:1) | 245 | 32.7 | 1.7<br>2.0* | 70.05 | - | - | - | - |

*) particle dimension of Pd, Pt determined by TEM

TPR diagrams (Figure 4) of Pd/Al, Pd/HY, and Pd/Al+HY (3 ratios of $Al_2O_3$:HY) catalysts had only one negative peak of $H_2$desorptionwith $T_{max}$ = 65 - 80$^oC$ (the plots in Figure 4 were inverted). According to Pawelec[9] for both Pd/Al and Au-Pd/Al samples, the presence of TPR peaks at about 81 $^oC$ indicates the reduction of PdO species interacting with the alumina surface. In addition, the TPR profile of the Au-Pd/ Al sample shows a peak at 31$^oC$, indicative the reduction of bulk PdO. The negative peak of $H_2$desorption at 84$^oC$ is attributed to $H_2$-desorption from the decomposition of a bulk palladium hydride formed through H-diffusion within the Pd crystallites [10]. So, the reduction peak on TPR diagrams of all palladium catalysts ($T_{max}$ = 65 - 80$^oC$) characterizes $H_2$-desorption from the decomposition of a bulk palladium hydride. It should be noted that, mixing of aluminum oxide to zeolite HY made the reduction extent of catalyst to be increased from 30% up to ~ 34 – 42%, depended on ratio of $Al_2O_3$: HY. This should be understandable, because on the mixed carriers the Pd dispersion improved with zeolite content (Table 1).