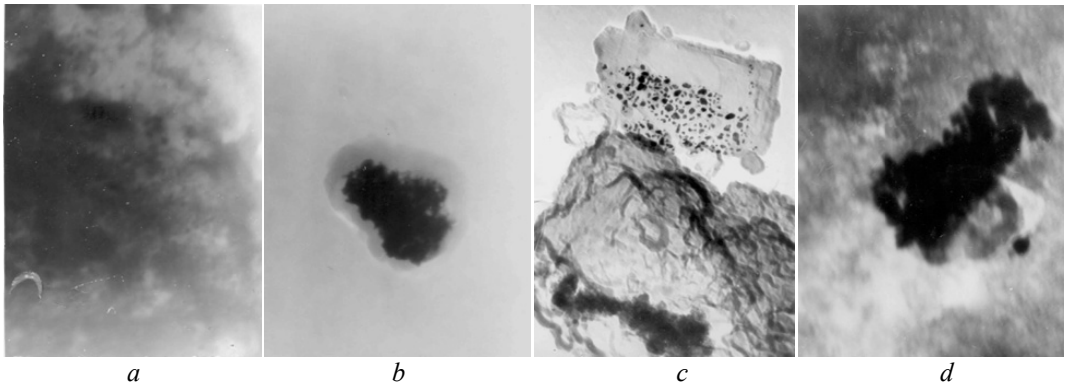
By method of electron microscopy (magnification of 120000) the extensive accumulation of loose particles with size of 80–100 Å was found in catalyst KT-17, micro-diffraction of them shows the formation of phase — Pt_3Mo (ICPDS, 17–719) (Fig. 2, *a*). Small unit of dense particles with size of 50–60 Å is observed in the same catalytic system (Fig. 2, *b*). According to micro-diffraction data, particles have close sets of interplanar distances corresponding to several phases of Pt-Fe: PtFe — tetraferroplatinum (JCPDS, 26–1139); (Pt, Fe) — platinum, ferroan (JCPDS, 29–717, 29–718); Pt_3Fe — isoferroplatinum (JCPDS, 29–716).

Accumulations of large Pt crystals (200 Å) with signs of cutting on the smooth surface of zeolite component of carrier are detected in KT-18 (Fig. 2, *c*). Small rounded clusters (dark particles) composed of CeO_2 particles of 30 Å size are visible. Circular micro-diffraction data of particles with size of 30 Å can be equally attributed to Ce_6O_{11} (JCPDS, 32–196) and Є-Fe_2O_3 (JCPDS, 16–835). Large cluster of 30–50 Å particles, which give circular diffraction of CeO_2 (JCPDS, 34–394) and unit of dense particles of 100–200 Å, microdefraction picture of which is represented by reflexes and can be attributed to sulfur (JCPDS, 27–101), were found in KT-18 (Fig. 2, *d*).



a *b* *c* *d*

a, b — KT-17; *c, d* — KT-18. Magnification 120000

Figure 2. Electron microscopy images of catalytic systems

Table 1 summarizes data on metal active sites of KT-17 and KT-18 catalysts nature.

Table 1

State and structure of particles in calcined (500°C, 5 h) zeolite-containing Pt(0,4 %)-Fe(5 %)/Al_2O_3 catalysts modified with cerium, molybdenum and phosphorus (KT-17) and with cerium and phosphorus (KT-18)

Chemical composition and dispersion of KT-17			
Iron	Platinum	Cerium	Molybdenum
Fe (d = 50–60 Å) $FeFe_2O_4$ (d = 100–300 Å) Fe_2PO_5 (d = 40–80 Å)	Pt (d = 50–60 Å) PtFe (d = 50–60 Å) Pt_3Fe (d = 50–60 Å) Pt_3Mo_2, β-Pt_3Mo (d = 80–100 Å)	CeP_2 (d = 40–50 Å) CeP (d = ~300 Å)	$MoOPO_4$ (d = ~15 Å) MoO_2 (d = 100–300 Å)
Chemical composition and dispersion of KT-18			
Iron	Platinum	Cerium	
Є-Fe_2O_3 (30 Å) η-Fe_2O_3 (d = 30–50 Å) Fe_2O_3 (d = 30–50 Å)	Pt (d = 200 Å)	CeO_2 (d = 30–50 Å) CeP (d = 100–200 Å) Ce_6O_{11} (d = 30 Å) $CeAlO_3$ (d = 30–50 Å)	

As it can be observed from Table 1, KT-17 catalyst sample contains homonuclear particles of Pt and Fe (50–60 Å), Fe_2PO_5, $MoOPO_4$ (15–300 Å) compounds, as well as homonuclear and heteronuclear clusters. Homonuclear clusters include $FeFe_2O_4$, molybdenum oxide MoO_2, the size of which varies from 100 to 300 Å. Heteronuclear clusters include PtFe, Pt_3Fe, Pt_3Mo_2, β-Pt_3Mo, CeP_2, CeP. These heteronuclear clusters have dimensions from 40 to 100 Å and 300 Å. According to electron-microscopic studies, KT-17 catalyst is nanostructured system of complex composition with particle sizes mainly from 15 to 100 Å.

KT-18 catalyst sample contains homonuclear particles of Pt, 200 Å in size, iron oxides and cerium oxides, the sizes of which range from 30 to 50 Å (Table 1). Heteronuclear cluster CeP (100–200 Å) and