Table S1. Raman modes vibrations and their corresponding assignations.

$PtMo/Nb_2O_5$

Raman shift (cm^{-1})	30-140 106 115 125 165 195 230 262 306 367 150-400		625 464 545 673	500-850 733	992 850-1000
Assignations	Vibrations of the Nb octahedrons and tetrahedrons Me-Me vibrations in which (Me=Mo or Nb) [21]	Cations occupying centers of octahedrons and tetrahedrons Bending of Nb−O−Nb bonds [23,25] Stretching modes of long Nb−O bond [21-24]	Oxygen framework vibrations bending of Nb-O-Nb at about 548 cm^{-1} [23,25] Stretching vibrations of the oxygen bonds Stretch of Nb-O-Nb bridges in octahedron and tetrahedron chains [21-24]		Vibrations of the Nb-O bond O-Nb=O bonds in highly distorted structures Mo-O bonds vibrations[10,21]

NiMo/Nb_2O_5

Raman shift (cm^{-1})	107 113 127 163 195 230 262 308 368 30-140 150-400	622 467 549 669 29 500-850	991 850-1000
Assignations	Vibrations of the Nb octahedrons and tetrahedrons Me-Me vibrations in which (Me=Mo or Nb) [21] Cations occupying centers of octahedrons and tetrahedrons Bending of Nb−O−Nb bonds [23,25] Stretching modes of long Nb−O bond [21-24]	Oxygen framework vibrations vibrations bending of Nb-O-Nb at about 548 cm^{-1} [23,25] Stretching vibrations of the oxygen bonds Stretch of Nb-O-Nb bridges in octahedron and tetrahedron chains [21-24]	Vibrations of the Nb-O bond O-Nb=O bonds in highly distorted structures Mo-O bonds vibrations

CoMo/Nb_2O_5

Raman shift (cm^{-1})	107 114 125 133 195 233 264 307 483 30-140	150-400	500-850 554 621 638 728	990 850-1000
Assignations	Vibrations of the Nb octahedrons and tetrahedrons Me-Me vibrations in which (Me=Mo or Nb)[21]	Cations occupying centers of octahedrons and tetrahedrons Bending of Nb–O–Nb bonds [23,25] Stretching modes of long Nb–O bond [21-24]	Oxygen framework vibrations vibrations bending of Nb-O-Nb at about 548 cm^{-1} [23,25] Stretching vibrations of the oxygen bonds Stretch of Nb-O-Nb bridges in octahedron and tetrahedron chains [21-24]	Vibrations of the Nb-O bond O-Nb=O bonds in highly distorted structures Mo-O bonds vibrations