Table S1. Raman modes vibrations and their corresponding assignations.

PtMo/Nb2O5

Raman shift	30-140											625		500-850	992 85	50-1000
(cm ⁻¹)	106	115	125	165	195	230	262	306	367	464	545		673	733		
	150-400															
Assignations	Vibrations	of the	e Nb	Catio	ons occup	ying cer	nters of o	ctahedro	ns and	Oxygen framework vibrations					Vibrations of the	
	octahedron	S	and	tetra	hedrons					bendi	ing of Nl	o-O-Nb at	about 548 ci	m ⁻¹ [23,25]	Nb-O b	ond
	tetrahedror	ns		Bend	ling of Nl	o-O-Nb	bonds [23	3,25]		Streto	hing vib	orations of	the oxygen	bonds	O-Nb=	O bonds in
				Stret	ching mo	des of lo	ng Nb–O	bond [2	1-24]	Streto	ch of Nb	-O-Nb bri	dges in octal	hedron and	highly	distorted
	Me-Me vib	rations								tetrah	nedron cl	hains [21-2	24]		structu	res
	in which (Me=Mo o	or Nb)												Mo-O	bonds
	[21]														vibratio	ons[10,21]

NiMo/Nb2O5

	1															
Raman shift	107											622		1	991	
(cm-1)		113	127	163	195	230	262	308	368	467	549		669	29		
														500-850		
	30-140				150-	400									850-1000)
Assignations	Vibrations	of the	e Nb	Catio	ons occuj	oving cer	ters of o	ctahedro	ns and	Oxyge	n framew	ork vibrati	ons vibrat	tions	Vibratio	ns of the
0	octahedron	s	and	tetra	hedrons					bendir	ng of Nb-C)-Nb at abo	out 548 cm	n-1[23,25]	Nb-O bo	ond
	tetrahedron	IS		Benc	ling of N	b-O-Nb	bonds [23	5,25]		Stretch	ning vibrat	tions of the	e oxygen b	onds	O-Nb=C) bonds in
				Stret	ching mo	des of lo	ng Nb-O	bond [2]	1-24]	Stretch	n of Nb-O-	-Nb bridge	s in octah	edron and	highly	distorted
	Me-Me vib	ations			0		0	L		tetrahe	edron chai	ins [21-24]			structur	es
	in which ()	Me=Mo o	or Nb)												Mo-O	bonds
	[21]														vibratio	ns
	[=+]														vioration	

CoMo/Nb₂O₅

Raman shift	107									500-850 554	621			990
(cm ⁻¹)		114	125	133	195	233	264	307	483			638	728	
	30-140				150-	400								850-1000
Assignations	Vibrations	of the	e Nb	Cati	ons occu	pying cer	nters of			Oxygen framewo	ork vibration	s vibratic	ons	Vibrations of
	octahedrons	;	and	octa	hedrons	and tetra	hedrons			bending of Nb-O	the Nb-O bond			
	tetrahedrons	5		Ben	ding of N	lb-O-Nb	bonds			Stretching vibrations of the oxygen bonds				O-Nb=O
				[23,2	25]					Stretch of Nb-O-	Nb bridges i	in octahee	dron and	bonds in
	Me-Me vibr	ations		Stre	tching m	odes of lo	ng Nb-O			tetrahedron chair	ns [21-24]			highly
	in which	(Me=M	o or	bon	d [21-24]		-							distorted
	Nb)[21]													structures
														Mo-O bonds
														vibrations