MEI

MEI.1 Zeolite framework type and topology

The designation of the framework type code (FTC) refers to the type material ZS**M**-**EI**ghteen (ZSM-18, Zeolite Socony Mobil with sequence number eighteen), a synthetic high silica zeolite with 3-rings of $(Si,Al)O_4$ tetrahedra. The framework structure (Fig. MEI.1.1) can be described as being built from *meg* ($4^6 4^6 5^6 7^3 7^3 12^2$) units forming the 12-ring channels (**kuc** units, Fig. MEI.1.3) parallel **c** crosslinked by *mei* ($3^1 4^3 5^3$) units as shown in Fig. MEI.1.2.

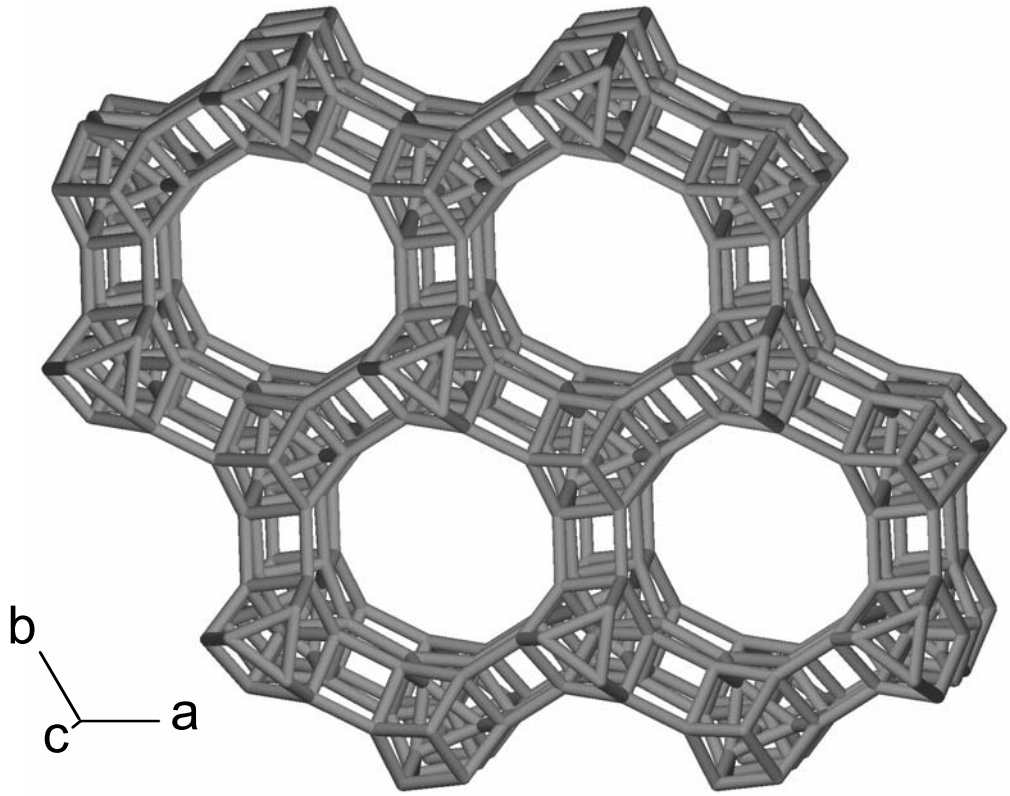
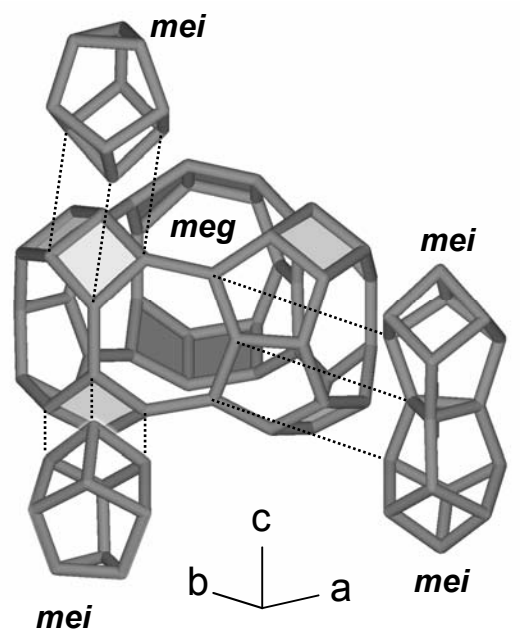
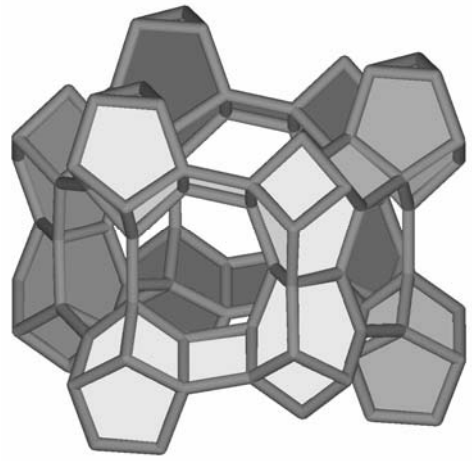


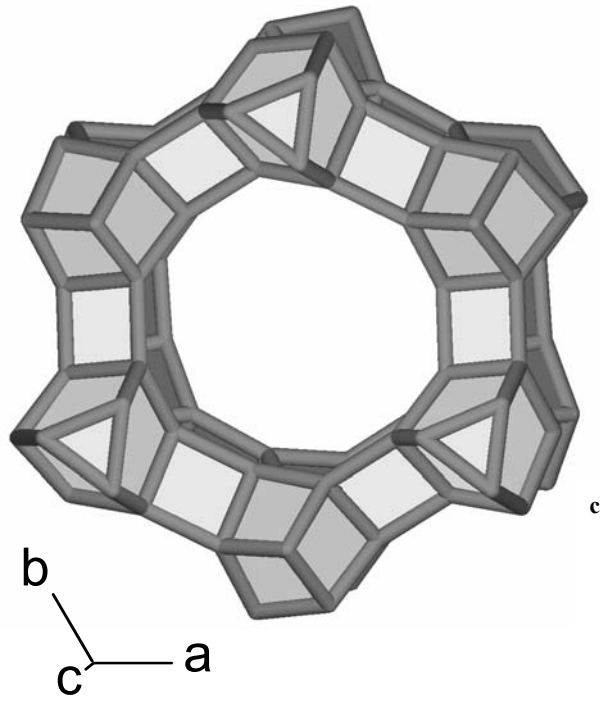
Fig. MEI.1.1 The framework structure of MEI-type zeolites in the highest possible topological symmetry $P\,6_3/m$. View parallel [001] rotated by 4° about [100] and [120].



a Linkage of *meg* and *mei* units. View parallel [$\bar{1}\,\bar{1}\,0$] rotated by 15° about [$1\,\bar{1}\,0$] and 8° about [001]. 4-rings of the *meg* unit are drawn nontransparently.



b The assemblage shown in a) with all *mei* units linked to one *meg* unit. All 4-rings and the mei units are drawn nontransparently.



c Top view of the assemblage shown in b) enclosing the 12-ring channel of the **kuc** unit (Fig. MEI.1.3). 3-rings, 4-rings, and 5-rings are shown nontransparently. Projection parallel [001] rotated by 5° about [100] and [120]. Scale is 126% relative to a) and b).

Fig. MEI.1.2 Building scheme of the MEI-type framework.

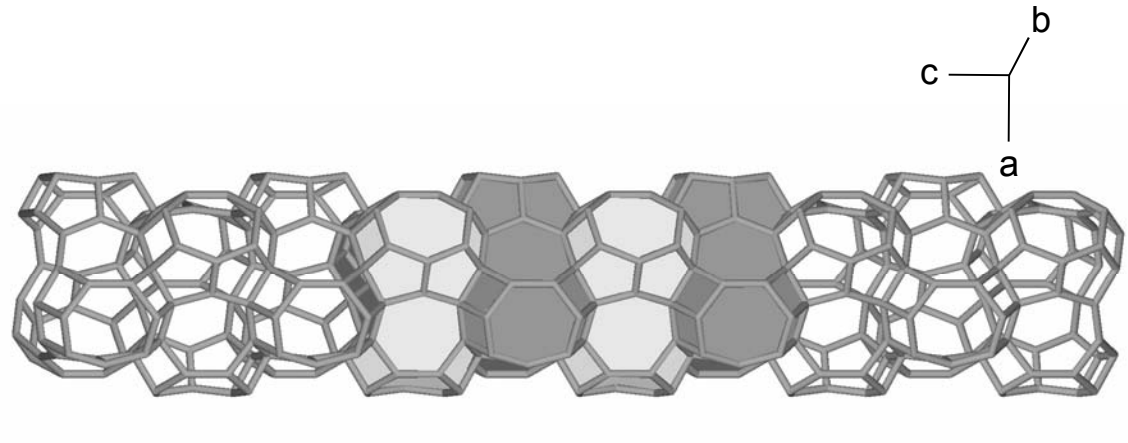


Fig. MEI.1.3 The 12-ring channel (**kuc** unit) parallel [001] formed by an alternating sequence of *meg* units rotated by 60° according to the 6_3-axis in the center of the channel. The four central *meg* units are drawn nontransparently. View parallel [120] rotated by 10° about [100].

MEI.2 Compounds and crystal data

Table MEI.2.1 Chemical data.

FD = framework density CE = cation exchange SR = sorbate T = temperature of thermal treatment [K]
SM = source of material TE = template TT = thermal treatment REF = reference

code	chemical composition	compound name	FD	SM	CE	TE/SR	TT	T	REF
MEI-I ***P*** **6_3/*m***									
MEI1990a01	$H_{1.7} \cdot Al_{1.7}Si_{32.3}O_{68}$ [1])	ZSM-18	14.3	S	-	-	C	n.s.	90Law1
MEI1992a01	$Si_{34}O_{68}$	ZSM-18	14.8	T	-	-	-	-	92Gal1
MEI2004a01	$H_4 \cdot Si_6 Al_{16}P_{12}O_{68}$	ECR-40	14.8	S	-	-	-	-	2004Afe1

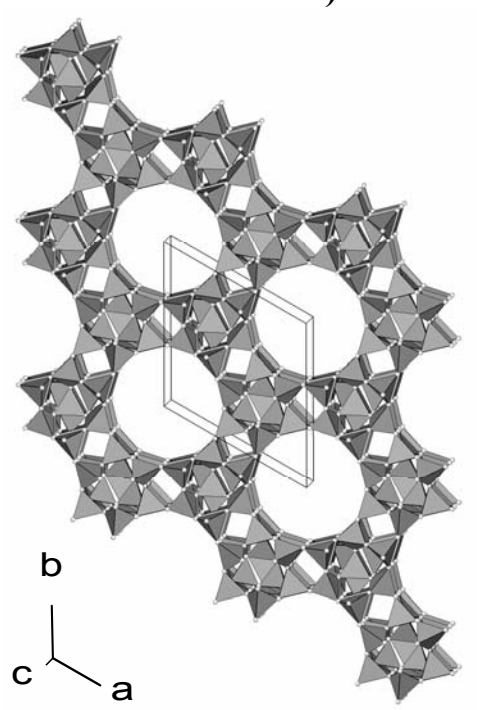
[1]) chemical composition assumed

Table MEI.2.2 Structural parameters of the MEI-type compounds.

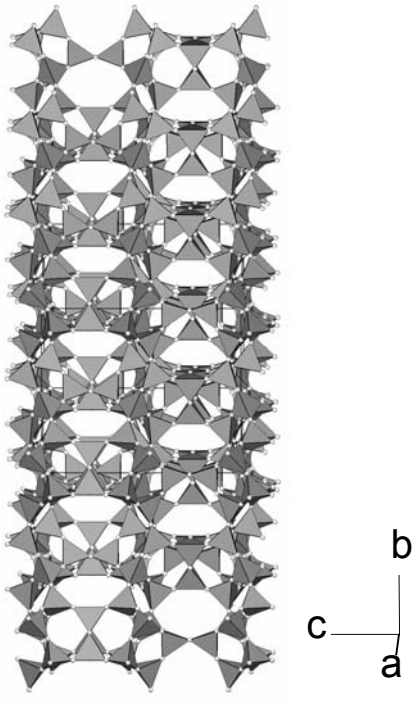
code	*a* [Å]	*c* [Å]	*V* [Å^3]	*T* [K]	reference
MEI-I ***P*** **6_3/*m***					
MEI1990a01	13.175(3)	15.848(6)	2382	n.s.	90Law1
MEI1992a01	13.035	15.591	2294	-	92Gal1
MEI2004a01	13.253	16.059[1])	2443	n.s.	2004Afe1

[1]) Unit cell constant *c* corrected from 15.059 Å [2004Afe1] to 16.059 Å.

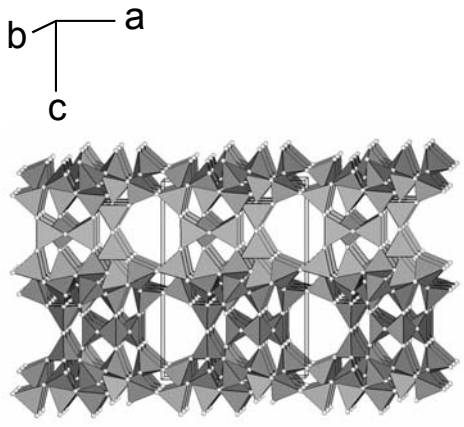
MEI.3 Framework structure of MEI-I compound ($P6_3/m$, IT #176)



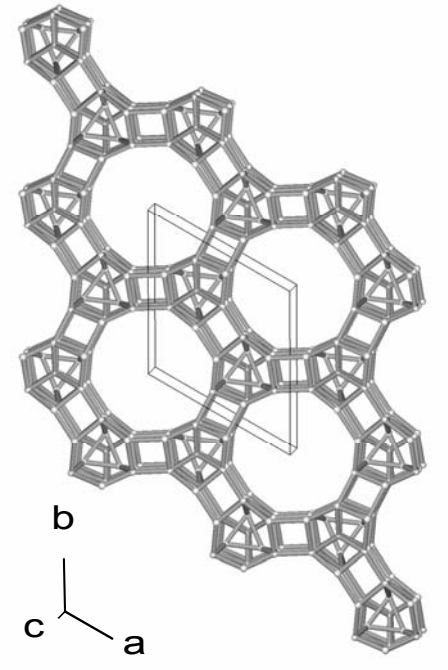
a View parallel [001] rotated by 2° about [210] and [010].



b View parallel [210] rotated by 1° about [001] and [010].



c View parallel [010] rotated by 1° about [210] and [001].



d Ball and stick model corresponding to a).

Fig. MEI.3.1 Projections of the MEI-I crystal structure of ZSM-18, $H_{1.7}Al_{1.7}Si_{32.3}O_{68}$ (MEI1990a01, 90Law1).

Table MEI.3.1 Atomic coordinates and site definitions for ECR-40, $H_4Si_6Al_{16}P_{12}O_{68}$ (MEI2004a01, 2004Afe1).

Atom	*x*	*y*	*z*	B_{eq} [Å^2]	site symmetry	Wyckoff position	no. of atoms in unit cell
P1	0.6772(3)	0.1496(3)	0.4715(2)	1.42(8)	1	12(i)	12
Al2	0.4541(3)	0.1186(3)	0.5647(2)	1.42(8)	1	12(i)	12
Si3	0.5281(4)	0.2128(4)	¾	2.1(2)	*m* . .	6(h)	6
Al4	⅔	⅓	0.3601(3)	2.1(2)	3 . .	4(f)	4
O1	0.6661(7)	0.2091(9)	0.3892(3)	1.74(8)	1	12(i)	12
O2	0.5876(6)	0.1468(5)	0.5306(4)	1.74(8)	1	12(i)	12
O3	0.4134(9)	0.1983(6)	0.5041(3)	1.74(8)	1	12(i)	12
O4	0.4558(5)	0.1473(5)	0.6684(3)	1.74(8)	1	12(i)	12
O5	0.6478(6)	0.0251(6)	0.4506(3)	1.74(8)	1	12(i)	12
O6	0.6506(11)	0.2129(8)	¾	1.74(8)	*m* . .	6(h)	6
O7	0.700(3)	0.345(8)	¼	1.74(8)	*m* . .	6(h)	2

Table MEI.3.2 Selected interatomic distances and angles for ECR-40, $H_4Si_6Al_{16}P_{12}O_{68}$ (MEI2004a01, 2004Afe1).

	T - O [Å]	T - O - T [°]		T - O [Å]	T - O - T [°]
P1 – O2	1.506(7)	157.9(5)	Al2 – O2	1.705(7)	157.9(5)
P1 – O3	1.522(7)	135.7(4)	Al2 – O4	1.706(6)	149.2(4)
P1 – O5	1.531(5)	149.7(5)	Al2 – O3	1.710(5)	135.7(4)
P1 – O1	1.583(8)	138.8(5)	Al2 – O5	1.714(6)	149.7(5)
Mean	1.536	145.5	mean	1.709	148.1
Si3 – O4	1.599(6)	149.2(4)	Al4 – O1	1.708(12)	138.8(5)
Si3 – O4	1.599(6)	149.2(4)	Al4 – O1	1.708(12)	138.8(5)
Si3 – O6	1.623(12)	134.0(4)	Al4 – O1	1.708(12)	138.8(5)
Si3 – O6	1.632(6)	134.0(4)	Al4 – O7	1.810(10)	155(2)
Mean	1.613	141.6	mean	1.733	142.9

Atomic coordinates (Table MEI.3.1) and interatomic distances (Table MEI.3.2) are given for ECR-40 [2004Afe1] representing the MEI-type structure with the most reliable experimental evidence. However, crystal structure drawings (Fig. MEI.3.1) are presented for ZSM-18 [90Law1] which are essentially identical with the cooreponding drawings for ECR-40.

MEI.4 Chemical composition

	D																
H																	He
Li	Be											B	C	N	***O***	F	Ne
Na	Mg											**Al**	**Si**	**P**	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe

Fig. MEI.4.1 Chemical elements (highlighted) occurring in the MEI-type compound. Framework cations are in grey fields.

MEI.5 Flexibility and apertures

Too little is known about frameworks of the MEI-type to be able to speak about their flexibility.

The 12-ring in the MEI framework is clearly narrower than in the FAU-type framework and does not even reach a diameter of 7 Å.

MEI.6 Other information

Nothing has been reported about useful properties of compounds having the MEI-type framework.

MEI.7 References

90Law1 Lawton, S.L., Rohrbaugh, W.J.: Science **247** (1990) 1319.

92Gal1 Gale, J.D., Cheetham, A.K.: Zeolites **12** (1992) 674.

2004Afe1 Afeworki, M., Dorset, D.L., Kennedy, G.J., Strohmaier, K.G.: Stud. Surf. Sci. Catal. **154** (2004) 1274.

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