# The Decasil Family



**1. The Periodic Building Unit (PerBU)** is the chain shown in Figure 1:

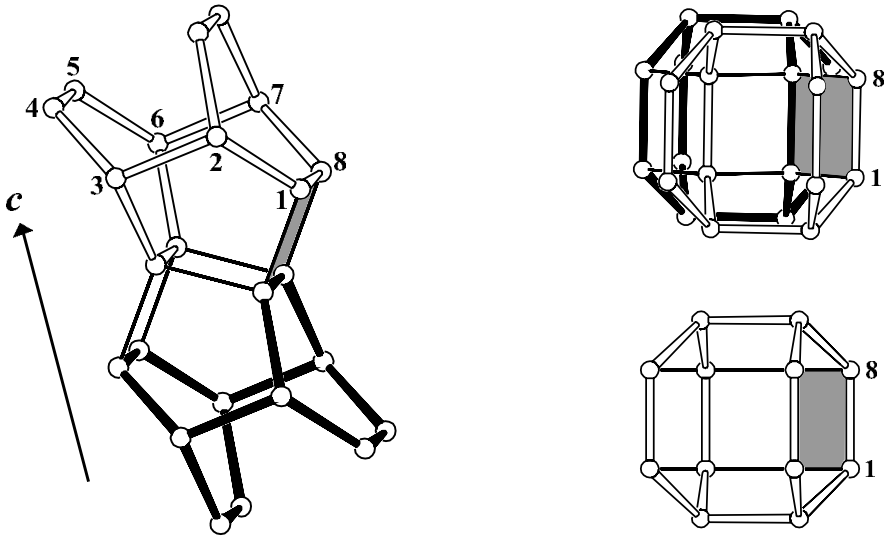


Figure 1: Perspective view of the PerBU in the Decasil family seen perpendicular to the chain axis ***c*** (a) and along ***c*** (b) in percpective view (top) and in parallel projection (bottom)

The PerBU in the Decasil family of zeolite frameworks is formed by connecting T12 units (two-fold connected double T6-rings; depicted in Fig.1a in bold), related by pure translations along ***c***, through T4-rings. As orientation sensitive indicator one of the T4-rings is shaded. The numbered T atoms are used in describing the connection modes.

**2. Type of Faulting:** 2-dimensional stacking disorder of the PerBU's along [100] and [010].

**3. The Rod Symmetry** of the PerBU is 2/m.

▲

**4. Connectivity Pattern of the PerBU:**

Neighbouring PerBU's can be connected via O-bridges in several ways:
- the chains are connected after pure translations. The connection modes are shown in **a**, **d**, **e** and **g** in Figure 2a.
- the chains are connected after a translation accompanied by a 180º rotation about the chain axis as illustrated in connection modes **b** and **c** in Figure 2a.
- the chains are connected after translation followed by a +90º or -90ºrotation about the chain axis. The resulting connection modes are given in **f** and **h** in Figure 2a.

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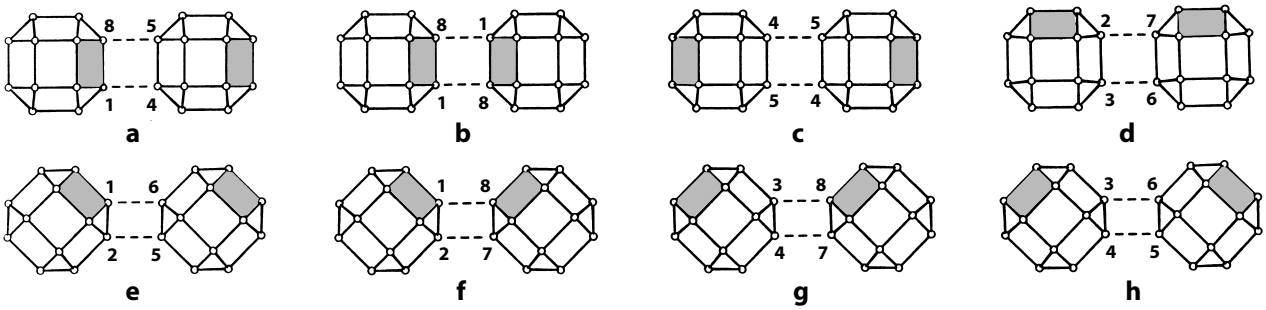
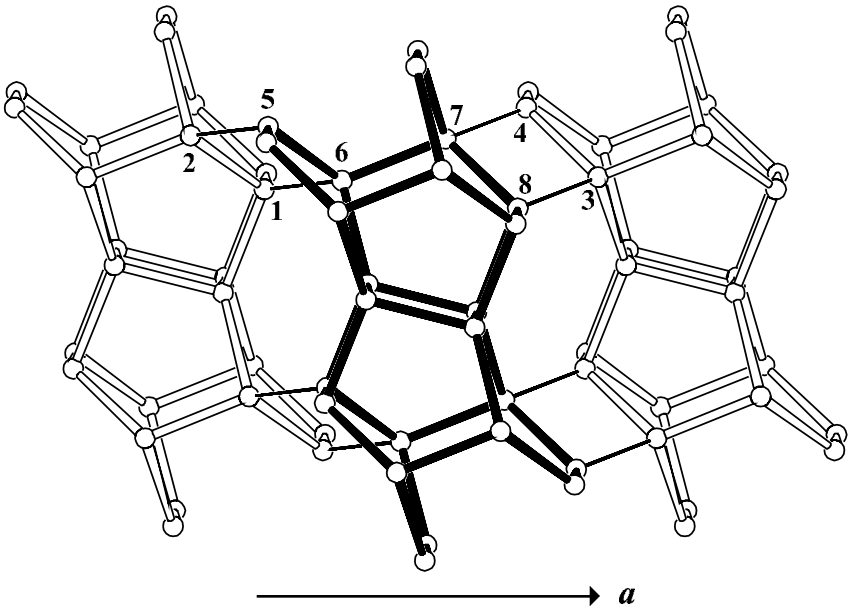



**(a)**




**(b)**

Figure 2(a): Connection modes, denoted **a** to **h**, of neighbouring PerBU's and (b): perspective view of the connection modes **e** and **g** where one of the PerBU's is drawn in bold

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The connectiomodes **b** and **c**, **e** and **g**, and **f** and **h** are pairwise identical. The modes in each pair are related by a 180º rotation about an axis perpendicular to the plane of the connected chains. Once the distribution of the connection modes in two dimensions is known the 3-dimensional structure is defined.

**5. The Simplest Ordered End-Members** in the decasil family are shown in Figure 3. Only end-member **1** has been observed as pure single crystal material and represents the framework with framework type code RTE (1,2).

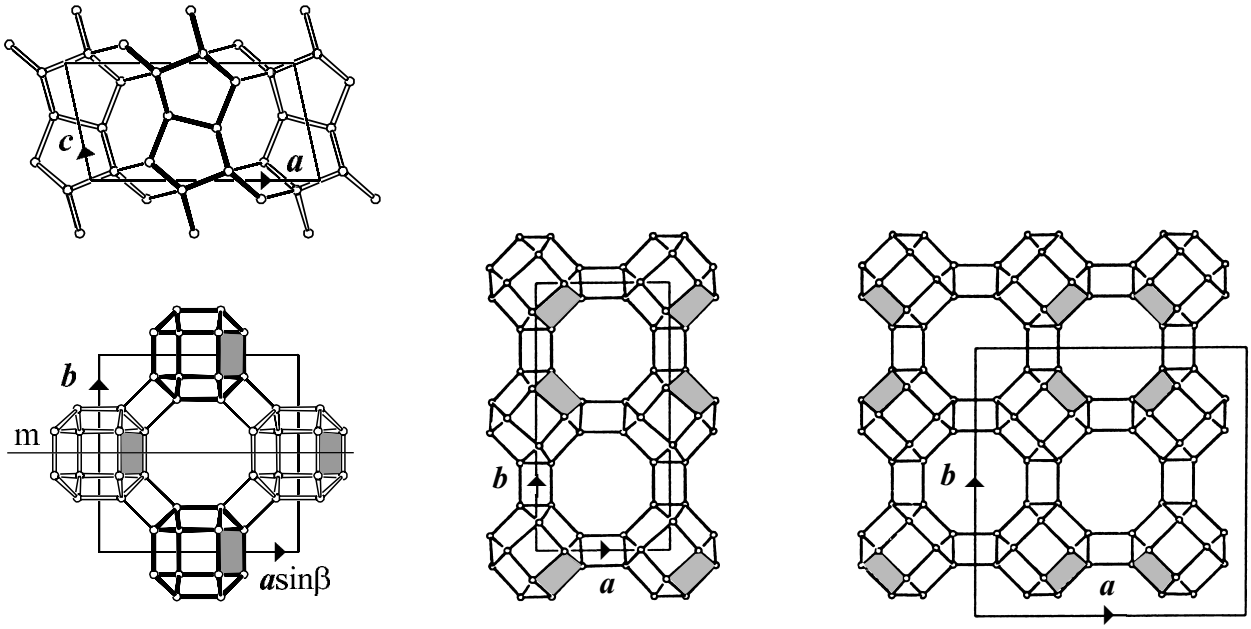


Figure 3: Projections of the unit cell content of the three simplest ordered end-members in the Decasil family (cf. Table 1). End-member **1**, seen along ***b*** (top) and along ***c*** (bottom), corresponds to the zeolite with framework type code RTE. The fourth PerBU, completing the cell content in RTE, is obtained by applying to the heavy bold PerBU in Figure 2b a mirror operation perpendicular to ***b*** (equal to the m operation indicated in Fig.3)

Table1: Connection mode of the rod-like PerBU along ***a*** and ***b*** for the simplest end-members in the decasil family. The end-member number refers to the framework plots given in Figure 3

| ***End-member*** | ***Sequence of the Connection Modes along a and b: (along a,.....; b,.....)*** | ***Space Group*** |
|---|---|---|
| **1** | (**e**,**e**,.....; **g**,**g**,.....) | C2/m [1] |
| **2** | (**g**,**g**,.....; **h**,**f**,**h**,.....) | P2/m |
| **3** | (**h**,**f**,**h**,.....; **h**,**f**,**h**,.....) | P4/mmm |

[1] This is end-member with framework type code RTE (1,2); in this framework the sequence of the connection modes given is along (-***a*** + ***b***) and (***a*** + ***b***), respectively.

**6. Disordered Materials Synthesized and Characterized to Date:**

RUB-4 (1,3)

## 7. Supplementary Information

to be added

## 8. References


(1) B. Marler, A. Grünewald-Lüke and H. Gies Zeolites **15**, 388 (1995).

(2) B. Marler, A. Grünewald-Lüke and H. Gies, Microp. Mesopor. Mater. **26**, 49 (1998).

(3) A. Grünewald-Lüke and H. Gies, Microp. Mater. **3**, 159 (1994).

(4) P. Daniels, J. Appl. Cryst. **31**, 559 (1998).