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

![Diagram of PerBU](image)

Figure 1: Perspective view of the PerBU in the Decasil family seen perpendicular to the chain axis $c$ (a) and along $c$ (b) in perspective 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 180° 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 +90° or -90° rotation about the chain axis. The resulting connection modes are given in f and h in Figure 2a.

The connection modes b and e, e and g, and f and h are pairwise identical. The modes in each pair are related by a 180° 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)

Table 1: 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.

<table>
<thead>
<tr>
<th>End-member</th>
<th>Sequence of the Connection Modes along $a$ and $b$: (along $a$,.....; $b$,.....)</th>
<th>Space Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(e,e,.....; g,g,.....)</td>
<td>C2/m 1</td>
</tr>
<tr>
<td>2</td>
<td>(g,g,.....; h,f,h,.....)</td>
<td>P2/m</td>
</tr>
<tr>
<td>3</td>
<td>(h,f,h,.....; h,f,h,.....)</td>
<td>P4/mmm</td>
</tr>
</tbody>
</table>

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


