BASF SE has been developing tailor-made wetting agents which meet these requirements.

**Background:**
- annually rising demand of copper ⇒ increasing prices
- ca. 20% of primary world Cu production by heap leaching processes + SX/EW
- so far recovery of conventional heap leaching processes range by 75-80% of the ore’s Cu-content during leaching periods of several months

**Target:** Improve productivity (recovery and leaching time) ⇒ by addition of wetting agents

**Heap leaching:**
Depends on solid-liquid-interactions at phase boundaries, capillaries

**Theory:**
According to Washburn eq., the penetration length $I_p$ of a fluid into a capillary is

$$I_p = \frac{r_K \cdot r_p \cdot \sqrt{2} \cdot \cos \theta}{2 \eta}$$

and 1st Fick’s Law the total leaching time $t(F=1)$ of an ore particle is

$$t(F=1) = \frac{2L \cdot r_c \cdot t}{3W_{c, \theta} \cdot D \cdot C_{\theta} \cdot n_0 \cdot r_p^2 \cdot \sqrt{2} \cdot \cos \theta}$$

can be influenced by wetting agents

**Requirements on wetting agents for heap leaching:**
- good wetting performance
- improved capillary penetration
- no negative impact on further processing steps (SX-EW)
- stable in acid solution
- low foaming
- biodegradable, no eco-toxicity

**Simulating heap leaching at IME-facilities**

**List of additives:**

<table>
<thead>
<tr>
<th>column</th>
<th>additive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 + 2</td>
<td>blank</td>
</tr>
<tr>
<td>3 + 4</td>
<td>nonionic surfactant (fatty alcohol alkoxylate)</td>
</tr>
<tr>
<td>5 + 6</td>
<td>nonionic surfactant (fatty alcohol alkoxylate)</td>
</tr>
<tr>
<td>7 + 8</td>
<td>anionic surfactant (alkyl ether sulfate)</td>
</tr>
</tbody>
</table>

**Results:**
- rise of Cu-recovery
- improvement in leaching kinetics