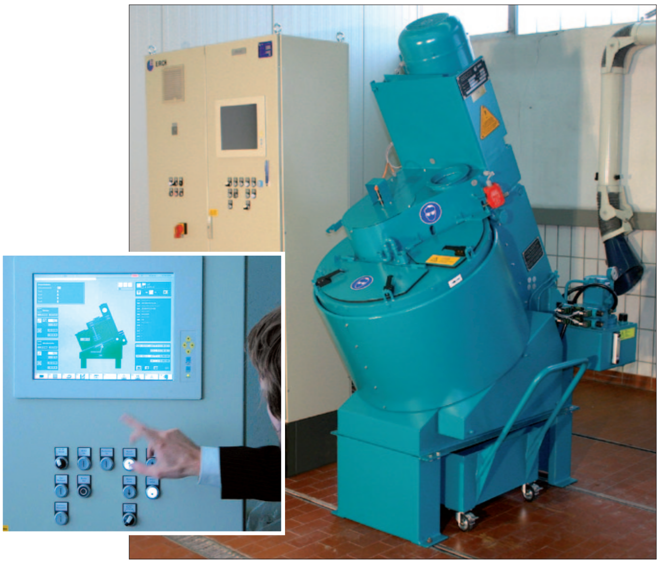
Mixer with sequence automation and process data control



Developed for modern concretes – useful for all industries

So far it has not been possible to quantitatively record and describe mixing processes. Concrete standards demand the mixing process to continue “until the mix appears to be homogeneous“. This does not provide objective reproducibility. When producing simple concretes in ready-mixed concrete plants, an approximate homogeneity is ensured on the basis of empirical values.
But when new concretes are developed, it is not possible to resort to empirical values. Eirich has therefore developed a control system – suitable also for laboratory mixers with a capacity of 40 and 75 L – that, on the one hand, measures and logs all machine parameters (e.g. speed of mixing pan and mixing tool, power draw of mixing pan and mixing tool, temperatures of the mix) and, on the other hand, calculates the power input into the mix. The mixing routine is thus documented and 100% reproducible. By watching the energy input it is possible to keep track when the concrete is “ready“.
This control system was first presented to professional circles in January 2005. Meanwhile, several universities (Munich, Kassel, Dresden, Leipzig, Vienna, etc.) have been working with it. From the Technical University of Munich a publication on SCC is available (beton 12/2005), from the University of Leipzig a publication on UHPC (BFT 1/2006).

Great future potential

Only mixers with process data control enable quantitative recording and description of the mixing process. With this innovative solution all machine parameters are recorded, memorized and displayed alphanumerically and graphically on a touch-screen monitor. The mixing instructions are managed via a PC that is linked to the mixer. Presented in the “mixer display“ are the experimental data entered by the user: the current operating conditions and measured values, as well as the current mixing step as defined in the formula by the user. Tool speeds, directions of rotation, pan speeds and the times for up to fifteen mixer steps can be determined over a wide range. During the mixing routine a batch log is generated documenting in tabular form and as a diagram how the mixing routine progresses. Speeds, power input, and temperature behavior are recorded by default. The data can be read out using a network interface or a USB stick. The mixer is operated via touch-screen and via additional pushbuttons easy to operate with gloves on. The mixer itself is distinguished by a rotating, inclined mixing pan transporting the process material to the mixing tool (rotor). The separation between material transport (by the mixing pan) and distributive and dispersive mixing (by the mixing tool) allows, in contrast to other mixing systems, the mixing tool to be run at variable speeds. While simple mixing systems maximally reach tool speeds around 1.5 m/s, the Eirich mixing system permits stable mixing processes in the range of 1 m/s to more than 15 m/s.
Furthermore, it is possible to operate at varying speeds during one and the same mixing process. A higher power input, and thus the higher input of shearing forces into the mix, is correlating with higher tool speeds. The introduced mixing work induces transposition processes, which ultimately represent the mixing process. When ultrafine materials are used that tend to agglomerate, a higher input of shearing forces has a positive effect on disagglomeration and thus improves the mixing result. In most cases agglomerates are not completely disintegrated in simple mixers, which causes e. g. strong variations in quality when producing SCC.
Taking SCC as an example, the Technical University of Munich could show that with the suitable mixing technology by means of a “hybrid mixing process“ (various speeds), the time for mixing SCC can be reduced from 240 s in a planetary mixer to 60 s (from adding the dry materials on). Interestingly, it was also possible to simulate the mixing quality of a planetary mixer in the Eirich mixer by mixing at a very slow tool speed (about 1.3 m/s).
The University of Leipzig demonstrated in the example of UHPC that a tool speed of approximately 10 m/s yields an optimal slump flow. Based on this knowledge, several universities are now using this mixer with process data control for their research and development activities in the field of UHPC. Comparative studies with double-shaft mixers show that the wet mixing times can be reduced by half thanks to higher tool speeds. Implementation of the results in large production mixers is viable. For mixer sizes between 75 L and 3000 L there is only one mixing tool (rotor). Hence, the material flows in a small mixer correspond completely to those in a large mixer.

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