Development and investigation of tight joints for sandwich elements in construction

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The objective of the project was to research longitudinal joints of sandwich elements regarding tightness. The research partners decided to focus on sandwich elements with steel faces and PUR core material. The most important aspect was to determine decisive parameters concerning transport of air, water and energy. In order to explore these parameters an in Europe unique test setup was constructed where tightness tests according EN 14509 can be performed. The test results provided the basis for a mathematical model by means of Computational Fluid Dynamics (CFD). Now, the airflow from different pressure levels for any joint geometry may be calculated. Thus, important guidelines for the design of improved joints were established. After the test setup started operation the tightness of numerous longitudinal joints was analysed. Results showed that generally the joints are tight to air and water provided that they are mounted professionally. All longitudinal joints tested during the course of the project complied with the value for air tightness demanded by the EnEV (German „Energieeinsparverodnung“), i.e. the A-value of $0{,}1 m^3/m \cdot h \cdot daPa^{2/3}$. Partly, they even fell significantly below this value. However, differences can be observed when comparing the joint tightness of different manufacturers. Innovative systems deliver extremely positive results. Recently, building owners demand in their contracts even better values regarding tightness than stated in EnEV. Regarding water permeability all joints tested within the project can be classified as Class A according to EN 14509. Regarding energy savings it has to be mentioned that part of the leakage of building envelopes runs across transverse joints and connections (e. g. roof connections, connections to the bottom slab, eaves, roof ridge). In order to declare tightness values for a certain product, e. g. for the CE-marking, only longitudinal joints can be taken into account. Transverse joints and connections are always completed on site and are therefore individual. Because the main focus of this FuE (Forschung und Entwicklung – research and development) project was the product-related tightness, only longitudinal joints were examined. The knowledge about the parameters air-, water- and energy transport through the joints allows a realistic simulation of the air flow volume through the joint by means of CFD. Thus, modified joints can be developed efficiently. Increased tightness and better insulation save energy and costs resulting in improved competitiveness. Construction of the test setup took significantly longer than originally planned because very precise and complex measuring equipment was installed. Therefore, optimisation process is still ongoing. But the framework is established by test results and mathematical simulation (CFD). Currently, new joint designs are being tested at iS-mainz in close co-operation with manufacturers. These joints are proven in practice with suitable sealings that are fault-tolerant. They guarantee longlasting tightness and easy mounting. Hence, this research project provides a basis for a systematic optimisation of longitudinal joints of sandwich elements. v