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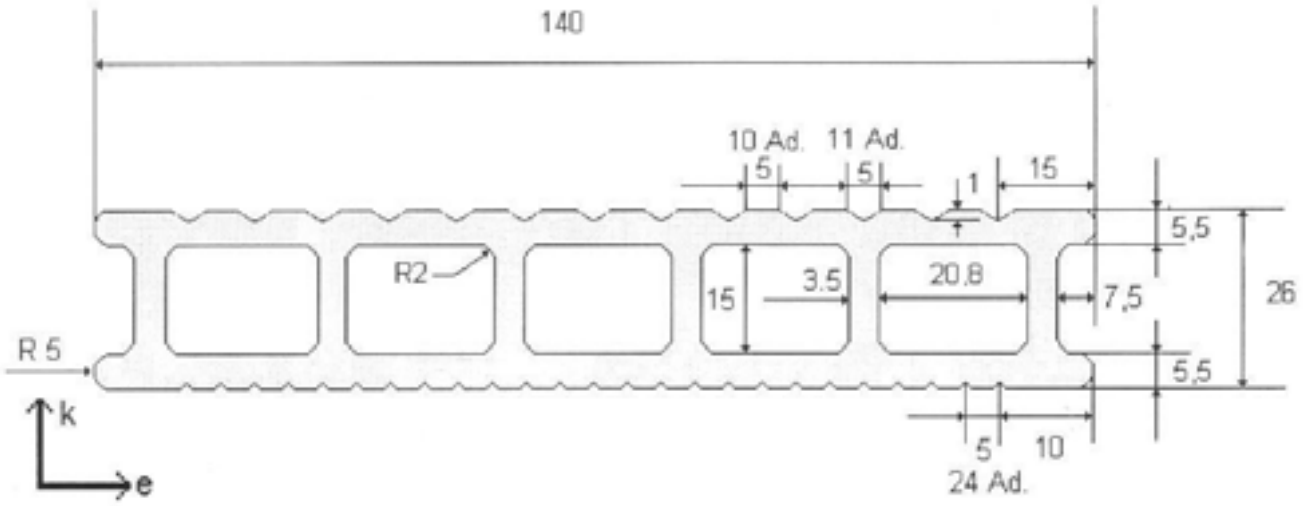
TESTS OF WOOD-PVC COMPOSITE PROFILE SAMPLES

Definition of Samples

The shape of samples collected according to TS EN 326-1 having a unique geometry is given below:



This composite panel having a 140.0 mm width has multiple sections along the cross-section. There are five sections along "e-direction" with a dimension of 20.8 mm × 15.0 mm (width×height). Each section has 5.5 mm and 3.5 mm thickness values in "k- (through both upper and lower sides) and e (axial)-directions", respectively. Total panel thickness is 26.0 mm.

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Density Test

The density of wood-polymer composite samples was measured according to ISO 1183-1 Method A: Immersion Method. The measured density value is calculated as the average value and found to be **1390 kg/m^3**.

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Flexural Modulus and Strength Tests

Flexural modulus and strength values were measured according to EN 310 standard. These mechanical tests were performed by using Hounsfield HKS10 universal testing machine. The measured flexural modulus and strength values were recorded by the installed software "QMAT" via a data acqusition program into the harddisk of the computer. Both results are given as the average values. The measured values for flexural modulus is **4600 MPa** and for strength is **34.46 MPa**.

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Water Absorption Test

The water absorption test of wood-polymer composite samples was measured according to EN 317. Weight measurements were carried out by means of a balance (VA304 Model GEC, Avery, England) with a 0.0001 g (0.1 mg) sensitivity. The measurement of thicknesses of each specimen, recorded at 24 hours time interval, was performed after the removal of excess water followed by the dipping period. Dimensional measurements were taken by using a Mitutoya IP65 digital micrometer having a 0.001 mm resolution . After the measurements, the percentage thickness swelling, $\%G_t$, value was calculated by:

$$G_t = \frac{t_2 - t_1}{t_1} \times 100$$

where t_1; the initial thickness of the specimen (mm) before immersing into the water and t_2; the thickness of the specimen (mm) after immersing into the water (mm). The arithmetic mean value of measured thickness swelling, G_t, is calculated and found to be **% 0.21 (thickness swelling)** for the test specimens.

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TESTS OF WOOD-PVC COMPOSITE PROFILE SAMPLES

Flammability Test (TS 1066)

The flammibility test of wood-polymer composite samples was measured according to TS 1066 ICS 83.080.01 standard and result was reported as "flammable", "inflammable" and "extinguishes by itself" statements. As a result of two ignitions and of tests carried upon two sets with 10 samples each, there was observed no flame spread and hence samples were evaluated as **"inlammable"** as distiguished in TS 1066 standard.

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HEALTH CONCERNS OF WOOD-PVC COMPOSITE PROFILES

The composition of wood-PVC composite samples was stated as;

- PVC
- natural wood shavings
- Ca/Zn stabilizer
- PMMA impact modifier
- lubricant (stearic acid)

by the manufacturing company UCM Kompozit Yapı Malzemeleri San. Tic. A.Ş. These materials are first mixed in a hot mixer and then transferred into a cold mixer. The obtained "dry-blend" is later extruded via "die"-"calibrator"-"haul off"-"saw" downstream equipment set up to obtain final product. Amongst the above-stated materials, natural wood shavings, Ca/Zn stabilizer, PMMA impact modifier and lubricant (stearic acid) are the necessary additives and extruded in a range of specified process temperature (about 150-215 °C) in order to obtain a final product and have no specified harmful effect to human health. The use of Ca/Zn stabilizers as being environmentally friendly and food-contact approved are encouraged in PVC industry. The stearic acid is also manufactured from either animal- or vegetable-oils. The PMMA material being polimerised fully and used as an impact modifier in PVC industry is also used in medical sector in various forms. Here, the content of PVC is important.

PVC is an amorphous polymer having 53-55% chloride within its structure. PVC is resistant to burning, acids and bases Water, alcohol and fuel oil do not have any effect on PVC.

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Vinyl chloride (VC) monomer (CH_2=CHCl) is the raw material for PVC. It is a colourless gas under normal conditions. It is stored in liquid form under pressure. VC is manufactured industrially from; 1) "Hydrochlorination of acetylene" (C_2H_2) and 2) Thermal cracking of 1,2-dichloroethane (EDC) obtained from the reaction of ethylene with chlorine gas. This process is called as "balanced process". Sometimes, the PVC manufactured via these two processes are called "acethylene-based" and "ethylene-based" PVC, respectively.

Hydrochlorination of acetylene process is abandoned due to catalysts used which are health hazardous materials. Today, more than 90% VC is manufactured by means of the balanced process method (Rossberg, 1986; Allsopp ve Vianello, 1992). In Turkey, PVC (ethylene based) is manufactured by using VC monomer obtained from the "balanced process". The industrial PVC manufacturing polimerisation methods are mainly (Wrede 1995):

- Suspension (dispersion) process (80% of world manufacturing)
- Emulsion process (12% of world manufacturing)
- Bulk polimerisation process (8% of world manufacturing).

In theses manufacturing stages, the VCM (vinyl chloride monomer) as being a toxic material must not remain even in small traces within the final product. The non-existance of such trace amount may be stated in the MSDS sheet of used PVC raw material. As stated in "Human Cancerogenic Materials" section of Encyclopaedia of Occupational Health and Safety (1983 and 1998), the TLV (threshold level value) of VC for a human is 5 ppm. Hence, the PVC material considered within the context of this report must be the type where any trace of VCM do not exist and whole VCM is polimerised as a must for the sake of human health. There are ways to determine hazardous elements in PVC. ICP (inductively coupled plasma) together with MS (mass spectrometry) or OES (optical emission spectrometry) and AAS (atomic absorption spectrometry) can be used for the determination of heavy metals. And, again, gas chromotography can be used to determine the toxic VC monomer in PVC products.

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The above statements are valid for all types of PVC product.

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