

ACEX170_Pyrolytic Carbon Black as Alternative Filler in Rubber Compounds for Rubber Cover of Conveyor Belts

The increasing demands for greening production and the drive to diversify raw materials are leading to the replacement of traditional fillers with materials from renewable or secondary sources. Given the high production volumes and the demands for durability, conveyor belts represent an ideal platform for the possible application of alternative fillers that can partially or completely replace commonly used fillers, such as carbon black. Given the possible application, the volume of commonly used carbon black filler N550, in the elastomer compounds recipe for application to the top rubber cover layer of category L (general use) conveyor belts, was replaced by the alternative filler AFC (**Tab.1**). Despite the significant decrease in tensile strength values, all prepared compounds meet the requirements for application according to ISO 22721. The decrease in tensile strength values when replacing the N550 filler with AFC is caused by a smaller ratio of particles per unit content, and thus a lower reinforcing effect, which is also demonstrated in the elongation at break values (**Fig. 1**). Elongation at break is the only property that increases its value due to the increasing AFC filler content, at the expense of the N550 filler. This effect was also observed in other compounds with increasing AFC filler content and is a consequence of a lower restriction of the mobility of the matrix chains. From the abrasion loss results (**Fig. 2**), up to 50% replacement of the commonly used N550 filler with the alternative AFC filler, the mixtures meet the requirements of industrial application. However, after exceeding the 50% AFC filler limit (mixtures CBC₄, CBC₅), the abrasion loss value increases above the maximum possible limit, thus excluding the mixtures from the possibility of industrial application. For the application of prepared compounds, the values after thermo-oxidative aging (168 hours at a temperature of 70 °C) are important (**Tab. 2**), as they determine the limit of change of all required tensile properties (maximum change 25%). All prepared compounds met the condition for tensile properties after thermo-oxidative aging and achieved a lower percentage change than 25%.

-Conclusion-

By summarizing the determined properties, it can be concluded that the prepared compounds meet all the requirements for application to the conveyor belts cover layer of class L in terms of tensile strength and elongation at break. The decisive property this time is the abrasion loss, which excluded from the possibility of application two compounds, namely CBC₄ and CBC₅, whose abrasion loss values exceeded the maximum possible limit (200 mm³). After thermo-oxidative aging and the condition of changing the values of properties such as tensile strength and elongation at break by a maximum of 25% from the originally determined, all prepared compounds met the requirements (CBC₄ and CBC₅ excluded even before thermo-oxidative aging). Despite the unsuccessful complete replacement of the N550 filler with the alternative filler AFC, it is possible to replace 50% of the N550 content. Complete replacement of the N550 content will be possible after adjusting the compound recipe (especially the vulcanization system, plasticizer content) as well as by reducing the particle size of the AFC filler (using a grinding and sieving process to obtain a smaller fraction).