KOKKUVÕTE

Autori eesmärgiks oli leida alternatiivseid kulumiskindlamaid materjale ettevõttes Snow & Wakeboard Solutions OÜ kasutavatele trossiketastele, mille esialgne materjal oli nailon PA6G. Alternatiivsete materjalide otsimise põhjuseks oli leida materjale, mis oleksid efektiivsemad kui nailon PA6G.

Lahenduste hulka kuulus alternatiivsete materjalide otsimine tarkvarast GRANTA EduPack 2021 R1. Erinevate piirangute seadmisel tulenevalt esialgsest materjalist ning süsteemi olemusest, leiti alternatiivsed materjalid asendamaks esialgset nailon PA6G materjali. Tulemused reastati suhtelise hinnangunumbrite summa põhjal. Saadud tulemustest kõige sobivamaks materjaliks osutus materjal nimega Polyurethane (r) (60% Long Glass Fiber). Tegu on plastiga, millel on suur kõvadus ja sitkus, mis tagab materjali suure kulumiskindluse.

Peale teoreetiliste tulemuste saamist, projekteeriti Tallinna Tehnikaülikoolis kulumiskindluse uurimiseks katsemasin. Et tulemused oleksid võimalikult sarnased reaalse olukorraga, arvutati vajalikud parameetrid masina seadistamiseks. Katsete läbiviimiseks hangiti erinevatelt Eesti ettevõtetelt materjalide näidiseid. Saadud materjalid töödeldi ümber masina jaoks sobiva suurusega katsekehadeks. Kokku valmistati ette kümnest erinevast materjalist kakskümmend katsekeha. Iga katsekehaga teostati kaks katset, seega kokku tehti nelikümmend katset. Katsekehad kaaluti enne ja pärast kulumiskatseid ning läbi materjali tiheduse leiti katse käigus kulunud osa maht. Mahu kadu järgi reastati tulemused, kus kõige vähem kulunud materjal osutus kõige kulumiskindlamaks. Katsetatud materjalidest osutus kõige kulumiskindlamaks ettevõtte poolt juba kasutusel olev nailon PA6G, mille keskmine kulumine 100 sekundilise katse jooksul oli 0.41 mm^2 .

Hilisemalt on plaanis uurida erinevate struktuuridega trosside mõju kulumisele. Lisaks oleks sobilik uurida muid alternatiivseid lahendeid kulumiskindluse tõstmiseks, näiteks erinevate komposiit materjalide kasutust või süsteemis olevate detailide kuju muutmist.

Kuigi laboratoorsetel katsetustel ei leitud kulumiskindlamat materjali, täideti kõik töö alguses püstitatud eesmärgid. Lisaks on lõputöö tulemiks ka valmistatud katsemasin ja kogu katse metoodika, tulevikus on võimalik antud katsemasinaga uuringuid jätkata. Töö autor ning ettevõte on tulemustega rahul.

SUMMARY

The author's goal was to find alternative, more wear-resistant materials for the rollers used by Snow & Wakeboard Solutions OÜ, the original material of which was nylon PA6G. The reason for searching for alternative materials was to find materials that would be more effective than nylon PA6G.

Solutions included searching for alternative materials in the GRANTA EduPack 2021 R1 software. When setting various restrictions due to the original material and the nature of the system, alternative materials were found to replace the original nylon PA6G material. The results were ranked by adding up the attribute ratings. From the obtained results, the material called Polyurethane (r) (60% Long Glass Fiber) turned out to be the most suitable material. It is a plastic with high hardness and toughness, which ensures high wear resistance of the material.

After obtaining the theoretical results, a test machine was designed at Tallinn University of Technology to study wear resistance. For the results to be as similar as possible to the real situation, the necessary parameters for setting up the machine were calculated. To carry out the tests, material samples were obtained from various Estonian companies. The resulting materials were reprocessed into test pieces of suitable size for the machine. In total, twenty test pieces were prepared from ten different materials. Two tests were performed for each test piece, so a total of 40 tests were performed. The test pieces were weighed before and after the wear tests, and the volume of the part worn during the test was determined through the density of the material. The results were ranked according to the loss of volume, with the least worn material being the most wear resistant. Nylon PA6G, which is already in use by the company, proved to be the most wear-resistant of the tested materials, the average wear was 0.41 mm2 during the 100-second test.

Later, it is planned to study the effect of different cable structures on wear. In addition, it would be appropriate to investigate other alternative solutions to increase wear resistance, for example the use of different composite materials or changing the shape of the parts in the system.

Although a more wear-resistant material was not found during laboratory testing, all the goals set at the beginning of the work were fulfilled. In addition, the result of the thesis is a manufactured test machine and the entire test methodology, in the future it will be possible to continue further research with this test machine. The author of the work and the company are satisfied with the results.