博 士 論 文 審 査 の 結 果 の 要 旨

氏名	CHUANG, YU-CHUN
学位名	博士（工学）
学位番号	甲第 721 号
論文題目	Research study on the reuse of textile waste selvage for high-performance mechanical properties: stab-proof and buffering applications （高力学特性的な応用を目指した繊維加工廃棄物の再利用に関する研究-防突き刺しおよび緩衝用途）
論文審査委員	主査　鮑　力民 森川　英明 若月　薫 坂口　明男 Wen-Cheng Chen　（Feng Chia University）

（博士論文審査の結果の要旨）

As the first chapter in this Ph.D. degree application and also ready for qualified dissertation mentioned: “In recent years, fibrous and textile products are applied to many other fields than garments and decorations. Due to the flexibility, lightweight, and easy process, they can easily combine with other materials. In addition to the intrinsic properties, they can also yield other required properties via the employment of different organizational structures and manufacturing processes. Fibrous and textile materials have a great diversity of applications, from domestic and industrial purposes to custom-made special functionality requests. Therefore, with the rapid development of the textile industry, and a large amount of textile waste has been produced.”

Accordingly, this thesis written by Ph.D. candidate Y-C Chuang is full of interesting investigations, well-structured organization, and written with innovative ideas and applications. Therefore, I am very pleased to express my highly recommendation about this thesis which could be qualified, especially the candidate Y-C Chuang has published 5 international peer review SCI papers, as I know, that is largely surpass the qualification of 3 SCI papers requirement for Ph.D final degree test.

The detailed structures, their established hypothesis and achievements in the dissertation written by Ph.D. candidate Y-C Chuang are listed as following items:

The Chapter 1 in Chuang’s dissertation mentioned the main topic of current status of textile wastes and the recycle technology by non-woven and related mechanism.

The Chapter 2 mentioned about the usage of recycle functional staple of Kevlar in personal protective equipment, the detailed analysis of tensile, tearing, and bursting strength in CD and MD directional differentiation has been measured.

The Chapter 3 described recycled aramid composite matrices, LMPET matrices, and aramid woven fabrics, which are laminated, needle punched and hot pressed, all the above mentioned tests and static puncture resistance as related to the employment of hot pressing were measuring. The study draws the conclusion about: hot pressing gives rise to the presence of thermal bonding points, which hampers the slipping of aramid and LMPET fibers, secures the structure, and increases the friction of fibers against the powerful punch.

The Chapter 4 is the extended application. The topic of “Mechanical and static stab resistant properties of hybrid-fabric fibrous planks: manufacturing process of nonwoven fabrics made of recycled fibers” has clearly presented the designated purposes. This study gave the constructive suggestions in practical industrial application about the issue: due to the recycled high modulus PET fibers are generally coated with oiling agent when it produced, which prevents LMPET fibers to form an adhesive layer during the hot pressing, and thus the interface bonding strength is low. The future studies need to remove the filling and

oiling agent before conducting the test for further discussion.

The Chapter 5 addressed another bonding technology applied in non-woven manufacturing process, the topic is “Fabric composites reinforced with thermally bonded and irregularly aligned filaments: preparation and puncture resistant performance” Compared to other studies, using the LMPET adhesive layer had a positive. Influence, preventing the slide of the filaments, but the poor interfacial combination only contributes limited reinforcement.
The Chapter 6 creates another application issue, the authors proposes an eco-friendly buffering materials using thermoplastic polyurethane (TPU) honeycomb grids and nonwoven fabrics that are composed of crimped PET fibers. Due to the largest quantity of recycled PET among all man-made fibers, the results are proven their study to have excellent buffering and protective properties.

According to this examined thesis written by Ph.D. candidate Y-C Chuang, many hypotheses about the waste textiles have been proved could be recycled used, even to be the up-cycled used not the down cycled usage. It would be actually applied If the recovery rate of these wastes can be improved, it can reduce wastes while creating new value and save the earth's resources.

Based on the above mentions of all item by item, this Ph.D. dissertation is deemed to be worth the recommendation.

（公表主要論文名）

1. Yu-Chun Chuang, Limin Bao, Ching-Wen Lou & Jia-Horng Lin. High-performance hybrid composites made of recycled Nomex, Kevlar, and polyester selvages: mechanical property evaluations. Yu-Chun Chuang, Limin Bao, Ching-Wen Lou & Jia-Horng Lin. The Journal of The Textile Institute 2019 May, doi.org/10.1080/00405000.2019.1619303 (Accepted)
2. Yu-Chun Chuang, Limin Bao, Ching-Wen Lou, Jia-Horng Lin. Hybrid-Fiber-Reinforced Composite Boards Made of Recycled Aramid Fibers: Preparation and Puncture Properties. Fibers and Polymers, 2019, Vol.20, No.2, 398-405. DOI: 10.1007/s12221-019-8868-1 (Accepted)
3. Yu-Chun Chuang, Limin Bao, Mei-Chen Lin, Ching-Wen Lou and Ting An Lin. Mechanical and Static Stab Resistant Properties of Hybrid-Fabric Fibrous Planks: Manufacturing Process of Nonwoven Fabrics Made of Recycled Fibers. Polymers (Basel), 2019, 11(7), 1140 (Accepted) DOI: 10.3390/polym11071140
4. Yu-Chun Chuang, Limin Bao, Mei-Chen Lin, Ting An Lin, and Ching-Wen Lou. Fabric Composites Reinforced with Thermally Bonded and Irregularly Aligned Filaments: Preparation and Puncture Resistant Performance. Polymers (Basel), 2019 Apr; 11(4): 706. (Accepted) DOI: 10.3390/polym11040706
5. Yu-Chun Chuang, Limin Bao, Pey Yu Chen, Ching-Wen Lou, Jia-Horng Lin. Buffering sandwiches made of thermoplastic polyurethane honeycomb grids: Manufacturing technique and property evaluations. Journal of Sandwich Structures & Materials, 2019, Vol. 21(6) 1975–1990. DOI: 10.1177/1099636217739547 (Accepted)