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Long Yu

Profile of the Author:

Prof Long Yu is currently Director of Sino-Singapore International Joint Research Institute, and senior research scientist in Monsh University (Australia). Prof L. Yu received his BE from South China University and Technology and PhD from Monash University. He had been studied and worked in Australia during 1988-2014. Prof L. Yu joints South China University of Technology and works as Team leader of Guangdong Innovative & Entrepreneurial Research Team Program in 2014.

He used to work in CSIRO, Australia as Principal Scientist for 18 years. Prof Yu has had more than 160 SCI papers published and citation time is more than 7800 (h-index 47). He has been selected as a Fellow of Royal Australian Chemical Institute in 2002, and currently been pointed as Editorial Board of 8 SCI journals. In the last 20 years, Prof Yu has been working on various polymeric materials from renewable resources. He has successfully developed and commercialized 8 products through spinning-off manuscript companies or transforming developed techniques to industries,

including various starch-based materials and products, such as pure starch-based plastics and medicine capsules and loss field foam.

淀粉基材料的发展

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基于石油短缺和减轻石油化学衍生聚合物对环境负担的现实问题，可生物降解的淀粉基材料的开发和生产得到了极大的推动。此外，不同淀粉的独特微观结构及其在热加工处理过程中的多相转变可以作为一个很好的模型体系，帮助更好理解聚合物中结构-加工-性能关系。多种常规的加工技术，如挤压、注射、压缩模塑和浇铸，以及一些加工新技术，如反应性挤出，已经应用于加工淀粉基聚合物。

由于在加工过程中可能发生多种化学和物理反应，淀粉基材料的加工比常规聚合物更加复杂和难以控制。在淀粉加工的多种相变中，糊化是特别重要的，因为它与其它转变密切相关，是淀粉转化为热塑性塑料必不可少的基础。挤出、注射、压缩模塑和流延等一些常规的加工技术，以及一些新技术，如反应性挤出，已经应用于淀粉基聚合物材料的加工。

为了克服纯淀粉基材料的缺点，如天然聚合物的力学性能较差以及合成聚合物的成本高；在过去的十年中已经开发出多种共混物和复合材料。以天然纤维和纳米颗粒为增强体的淀粉基材料已发展成为各式各样的环保型复合材料。淀粉的亲水性特性提供了与纤维素和纳米粘土相容性的优势。增容剂和反应挤出技术广泛用于改善天然聚合物和合成聚合物的界面。

目前，已经开发了诸多改性淀粉以克服天然淀粉的各种缺点，并扩展其应用。另一方面，为了克服诸如机械性能和湿敏性差的缺点，近十年来各种共混材料和复合材料也得到了发展。

多种已经开发并商业化的淀粉基产品：

DEVELOPMENT OF STARCH-BASED MATERIALS

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The development and production of biodegradable starch-based materials have been spurred by oil shortages and the growing interest in easing the environmental burden of petrochemically derived polymers. Furthermore, the unique microstructures of different starches and their multiphase transitions during thermal processing can be used as an outstanding model system to illustrate our conceptual approach to understand the structure–processing–property relationships in polymers. Various conventional processing techniques such as extrusion, injection compression molding, and casting, as well as some new techniques such as reactive extrusion, have been adapted for processing starch-based polymers.

The processing of starch-based materials is much more complex and difficult to control, than that of conventional polymers because the multiple chemical and physical reactions might occur during the processing. Among various phase transitions of starch during processing, gelatinization is particularly important because it is closely related to the others and is as the indispensable basis of the conversion of starch to a thermoplastic. Various conventional processing techniques such as extrusion, injection, compression molding and casting, as well as some new techniques like reactive extrusion, have been adapted for processing starch-based materials.

In order to overcome disadvantages pure starch-based materials have, such as poor mechanical properties found in natural polymers; or the high price of synthetic polymers, various blends and composites have been developed in the last decade. The starch-based materials reinforced with natural fibres and nano-particles have been developed to various environmentally friendly composites. The hydrophilic properties of starch provide the advantage of compatibility with cellulose and nano clay. Compatibilizers and the technology of reactive extrusion are used to improve the

interface between natural and synthetic polymers.

Many modified starches have been developed to overcome various shortcomings of native starches, and to expand their applications. On the other hand, in order to overcome disadvantages such as poor mechanical properties and moisture sensitive various blends and composites have been developed over the last decade.

Various starch-based products have been developed and commercialized:

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