Preface for the Soft and Green Manufacturing and Applications

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Recent technological developments in soft devices and materials have placed a lot of focus on bringing electronic and mechanical devices closer to humans. While these devices were previously located far away from humans by operating solely in factories or within rigid boxes with which users seldom physically interacted, future devices are poised to interact much closer with humans in their everyday life. They have the potential to become healthcare assistants or domestic workers, skin-like wearable electronic components and morphing appliances, or even devices operating directly from within their body.

Devices that do not operate in direct contact with humans do not need to be designed to be inherently safe for operation around humans as rigid barriers can be built to separate them. This can include a rigid box in which electronic devices are installed or a rigid enclosure in which an industrial robot operates. These barriers can help guarantee that no accidents will occur but placing these devices closer to human requires to tackle issues related to safety and convenience of use. This can only be done by revising their core concepts and building devices that have little in common with their ancestors. Thus, the use of soft, flexible, stretchable, bio-compatible, or even edible electronic or mechanical devices is likely to become core technologies for deeper and safer interactions with humans.

The development of stretchable/flexible electronics, optics, structures, and sensors has required novel approaches

at every step including new design philosophies, new material development, and novel manufacturing processes. These developments have often been guided by the needs of a wide range of applications which had not been considered previously in conventional rigid devices, and many leading research centers and companies have devoted significant effort to develop such technology and to apply them in human-friendly futuristic products. Another device for which soft replacements are being investigated is the traditional robot made from gears and rigid parts as they are bulky, heavy, and unsafe to work with humans. New actuation and sensing approaches that enable these robots to be compliant and lightweight have attracted significant attention from the public. Last, most human-made devices are made from materials that do not resemble those from which humans and animals are made, so bioprinting and biomanufacturing processes have a huge potential to directly manufacture products that are biologically safe.

This special edition will focus on the manufacturing and applications of soft and green devices to build a bridge between different technologies and promote their discussion within the scientific community. The topics being discussed in this special issue are as follows:

- Stretchable/flexible electronics, optics, structures and sensors
- Soft/green robotics and actuators
- Bio printing/manufacturing process
- Machine-robot interface

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