Research Assessment Exercise 2020
Impact overview statement

University: The Hong Kong Polytechnic University
Unit of Assessment (UoA): 8 Materials science and materials technology
Total number of eligible staff of the university in the UoA: 19

(1) Context

We are motivated by commercial opportunities, social and industrial challenges as well as our keen desire to share our expertise with the public. Our focus on materials science creates opportunities to develop energy solutions, advanced sensor innovations, smart and functional textiles and mode-locking lasers. We engage and interact with a wide variety of non-academic user groups including over 40 industrial partners, the general public (over 1.3 million viewers via TV episodes) and 300 secondary schools (500 teachers and 1800 students) to maximise the impact of our research.

(2) Approach to impact

Industrial Collaboration – One mechanism we use to establish and build relationships with industry is through our *Departmental Advisory Committee.* We invite members of relevant industries to serve on our committee, which currently has 7 members from commercial and government sectors. Interactions with industry play a major role in the impacts we have achieved. Our unit has appointed an *Industrial and Consultancy Liaison Officer* who facilitates our new interactions with over 40 different partners during the period. About 25% (5) of our members are actively engaged with industry such as Tsang's strong collaboration with *Fianium* (a world leading fiber laser manufacturer) to develop next generation mode locking lasers. This collaboration has led to two Innovation Technology Fund (ITF) projects as well as four patents filed. The newly developed saturable absorber materials could significantly reduce production costs and broaden the operational wavelengths of mode locking lasers. A further example is Zhang's collaboration with *Geb Impact Technology* to develop a microfluidic platform that identifies, selects and cultivates highly-productive microalgae strains by rapidly mass screening large quantities of mutant microalgae for the commercial production of advanced nutrient components and biodiesel.

Commercialization – We encourage licensing, patenting and spin-outs, providing support via our University's *Technology Transfer Office* and *Entrepreneurship Unit.* Our research has spawned four startup companies - *LabWork* (2018), *Nanothink* (2016), *Ningbo Aide Intelligent Company* (2016) and *AdvanPro* (2011) – creating around 100 jobs. By encouraging interdisciplinary research through cross-departmental seminars, colleagues have entered collaborations with our sister department the *Institute of Textiles and Clothing* (ITC) on near-market research projects such as creating conductive fabric and anti-corrosion barriers for wearable devices (*see Case Study 2*), anti-bacterial chitosan fabric tested in hospitals, and the development of environmentally-friendly functional cotton. Showcasing our research achievements via innovation fairs and media coverage attracts industry interest and partnerships, for example licensing deals with *LinkZill* for non-invasive glucose sensors and *Jiangsu ZJA New Material* for our infrared functional textile.

Public and Schools engagement – Our unit launched a pioneering remote-controlled-experiments laboratory (*RemoteLab*) in 2014 to serve local secondary schools. This platform allows subscribers round-the-clock access to setups normally inaccessible to schools due to costs and/or safety concerns. We have expanded to reach more than 40 local secondary schools, winning the Reimagine Education Asia Gold Award 2016 for our innovative approach to promoting scientific experimentation. The *HK Education Bureau* has officially recognized our platform as an alternative for conducting physics experiment assessments. In 2018 our *LabWork* spin-off was established to commercialize this platform. Supported by the *Quality Education Fund,* we are also exploring the use of mobile devices and low-cost microprocessors (Arduino, Raspberry-Pi) to perform out-of-classroom physics experiments. These engagement activities have directly served over 1800 students from around 60

schools, and through our '*Train the Trainer'* workshops in 2018 to 2019, we reached a further 240 schools and 500 teachers.
Our staff also actively share expertise through delivering popular science lectures and school talks exploring topics such as 2D materials and acoustics, general physics, and materials science. We have also been regularly (30 episodes so far) featured in the popular TV science show 'Sidewalk Science' since 2015. Each episode reaches over 1.3 million viewers. We run two YouTube education channels, one hosting videos about *RemoteLab* experiments and another delivering tutorials on math skills for physics. These two channels have garnered over 400 and 2800 views respectively since 2016, reaching over 450 students in 15 secondary schools.
Facilities and support - We attract a wide-range of industrial users with our *UMF* and *UCEA* facilities (*see Enviro Statement*). Our *Industrial and Consultancy Liaison Officer* investigates their needs and identifies research collaboration opportunities, some of which have led to *ITF* grants. Our *Institute for Entrepreneurship* delivers courses and workshops on innovation and entrepreneurship for staff and students, fostering a culture of innovation at all levels. Three of our research students have obtained university Micro Funding (HK$100K to 120K per project) to turn their 'Do Well Do Good' entrepreneurial ideas into start-ups (*Nanothink*, *Labwork* and *AdvanPro*).

(3) Strategy and plans
Building on our successful record of public engagement, over the last six years we have increasingly connected with other potential beneficiaries of our research. Since 2018, every 6 months, our *Departmental Research Committee* meets to explore potential pathways to impact from our research and ensures that identified opportunities are ascribed an owner for further action. Three projects so far identified have each been provided with a HK$200K seed fund. We will continue to form new external partnerships and enhance the impact of our research programme by a combination of strategies:

- *Promoting a cultural change to maximise impact generation* – our strategy includes investment in our existing staff through: training to spot and pursue new impact opportunities, funding staff exchanges with industry, extending our pilot seed funding for translational research, and recognising and rewarding (e.g. through salary increment) impact generation activities via our annual appraisal system.
- *Targeting impactful research to build on our world-leading position in beam-sensitive materials* - our strategy includes appointing new academic staff in targeted high potential impact research areas, investing in infrastructure through acquiring state-of-the-art research facilities (e.g. new TEM facilities worth over $60 M) and building on our areas of research excellence to target new opportunities for impact in areas of global importance such as energy materials.
- *Facilitating greater collaboration with other departments of the university*, such as *ITC*, *Biomedical Engineering*, and *Health Technology and Informatics* through joint seminars and joint appointments we will leverage their knowledge and expertise in engaging with the textile, medical and healthcare sectors.
- *Undertaking and developing a high-profile outreach and public engagement programme*, building on our long-standing and successful approach – we believe our *RemoteLab* and *Train the Trainer* programmes can reach even more beneficiaries, especially in the Greater Bay Area, and we will expand those initiatives with the over HK$5M funding secured in 2019.

(4) Relationship to case studies
The two impact case studies provide strong evidence of our commitment to collaborating with non-academic users and to exploiting research with commercial potential. Case Study 1 demonstrates the tangible benefits of building and sustaining long-term relationships with companies. This partnership was supported with *seed money* from the department. Case Study 2 illustrates impact from our approach of encouraging *cross-departmental interdisciplinary research*, and utilising university support (e.g. *Micro Fund*) for start-ups. The success of these cases helps inform our future strategy and plans.