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is Special Section is devoted to the research and development activities of all areas of flexible electronics science and technology. We have a selected number of high impact technical papers presented at the first IEEE International Flexible Electronics Technology Conference (IFETC) in 2018 for publication in J-EDS. The first IFETC was held in Ottawa, Ontario, Canada from the 7th to 9th August, 2018. The conference was financially sponsored by the IEEE Council on RFID, and technically sponsored by the National Research Council Canada, IEEE Electron Device Society, and the IEEE Instrumentation and Measurement Society. The conference was dedicated to the advances in flexible electronics in all areas of science and technology, and provided an opportunity for scientists, researchers, engineers, developers, and users in the field to share, discuss, and witness new concepts and ideas. A wide spectrum of academic research results was presented, with potential applications in current industrial technology and new application driven domains.

The 2018 IFETC comprised of educational and technical sessions. The final technical program had more than 130 presentations including six plenary talks, seven tutorials, three workshops, over 30 invited talks by world renowned experts in the field, and more than 90 contributed technical presentations.

The conference covered all areas of flexible electronics, including RFID, flexible antenna and microwave devices, flexible transistors, flexible photovoltaics, flexible energy harvesters, flexible sensors, flexible lighting and displays, smart textiles and wearables, integrated circuit designs, and novel materials and processes. For this special section in the IEEE Journal of Electron Devices Society (J-EDS), a selected number of the top-rated presented articles in the conference were technically extended by the authors according to IEEE guidelines and carefully reviewed by the J-EDS reviewers are published.

A total of seven articles have been accepted for this special section that represent different aspects of flexible electronics. And authors representing North America, Europe, and Asia.

Ton et al. from the National Research Council Canada demonstrated that smooth, continuous silver lines could be printed via control of ink-substrate interactions, despite the tendency of the ink to dewet from the substrate. The silver lines were printed using drop-on-demand inkjet printing of silver nanoparticle ink onto non-crosslinked SU-8 coated polyethylene terephthalate (PET). The lines were subsequently heated to control dewetting and cause contraction from 60 μm to 14 μm. The SU-8 film underneath the silver line was dissolved and redistributed to form a ridged concave structure that prevented the lines from bulging and breaking apart. Additionally, photonic sintering was used to achieve low resistivity of 0.06 μΩ-m for the narrow printed lines.

The paper by the VTT team of Finland presented challenges and solutions for the hybrid integration of printed and flexible electronics in combination with conventional electronic components to create new product concepts. In the example presented, roll-to-roll printing was used to print the electronic backplane and a co-planar electrochromic display; a pick-and-place assembled microcontroller unit and accelerometer. Together with passive components provided the brains for the system. Injection molding was then utilized to create a structural electronics system with electrochromic display.

Cantarella and et al. from Italy, Switzerland, U.K. and USA demonstrated 7 × 7 passive arrays on rigid and flexible substrates. They green perovskite LEDs (PeLEDs) on 50 μm thick polyimide substrates. Using colloidal 2D formamidinium lead bromide perovskite emitter, the PeLEDs show a high current efficiency (ηCE) of 5.3 cd A-1 with a peak emission at 529 ± 1 nm and a narrow width of 22.8 nm. The resultant green emission shows color saturation >95%, in the Rec. 2020 standard gamut area. The device functionality is tested by dynamic bending experiments down to 10 mm for up to 5000 cycles, resulting in device lifetime over 36 h in a glove box and a drop of ηCE and external quantum efficiency (ηext) as low as 15% and 18%, respectively.

Burghartz and et al. from Germany report on the status of a comprehensive ten-year research and development effort towards Hybrid System-in-Foil (HySiF). In HySiF, the merits of high-performance integrated circuits on ultra-thin chips and of large-area and discrete electronic component implementation are combined in a complementary fashion in and on a flexible carrier substrate. HySiF paves the way to entirely new applications of electronic products where form factor, form adaptivity and form flexibility are key enablers. In this review paper the various aspects of thin-chip fabrication and
embedding, device and circuit design under the impact of unknown or variable mechanical stress, and the on-and off-chip implementation of sensor, actuator, microwave and energy supply components are addressed.

Shafiee and et al. from USA and Malaysia present the printing of a functional electronic material that exhibits ROS (reactive oxygen species) scavenging behavior (Manganese III 5, 10, 15, 20-tetra 4-pyridyl-21H, 23H-porphine chloride tetrakis methochloride) using a modified inkjet printer. Different printed pattern schemes that were designed based on the amount of overlap among sequential droplets were used to tune the surface morphology of the inkjet-printed thin films with a wide range of roughness (8.84 to 41.20 nm). Furthermore, post-printing processes (such as plasma treatment) were used to optimize the surface energy.

Li and et al. from University of Waterloo (Canada) proposed a self-compensating 6-TFT pixel circuit with special layout considerations to mitigate the impact of the electrical instability of a-Si:H TFTs as well as applied mechanical strain. The proposed pixel circuit has been fabricated onto flexible polyethylene naphthalate (PEN) substrate and measurement results demonstrated less than ±3% variation of its output current after an accelerated 24-hour stress test under flat, tensile strain, and compressive strain conditions. In addition, the proposed pixel circuit only required a pair of signals to operate, which reduced the complexity on external IC drivers.

Hasan and et al. from Korea report the impact of carbon nanotube (CNT) buried layer in the middle of 7 μm polyimide (PI) substrate on the electrical performance of amorphous-indium-gallium-zinc-oxide (a-IGZO) thin-film transistors (TFTs) by repetitive mechanical stretching. TFT arrays on 3 mm × 3 mm PI layers were attached on 40 μm poly-dimethylsiloxane (PDMS) substrate by double-sided PI tape. A negative threshold voltage shift of −3 V was observed under 70% mechanical stretching for the TFTs on conventional PI substrate, whereas the TFTs with CNT layer inside PI substrate exhibited robust TFT performance. The fabricated oxide TFTs reported here with CNT inside PI substrate shows a field effect mobility of 14 cm²/V s in the pristine state, with < 5% change after repetitive mechanical stretching and bending. This may be attributed to the strain-absorbing CNT layer inside PI substrate as indicated by TCAD simulations.

Finally we thank both the authors and the reviewers for their efforts to ensure a high quality of articles in this special section. Special thanks goes to Mrs. Marlene James for her assistance with the editorial process.

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