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	Ref#	Project Name	Description	Primary Therapeutic Area	Secondary Therapeutic Area	Technology Type	Tag(s)	Lead PI Last Name	Lead PI First Name	PI Department	Stage of Development	Commercialization Focus
	4912	Voxelated Molecular Patterning in 3-Dimensional Freeforms	Molecular patterning often relies on the self-assembly of liquid crystalline polymers (LCPs) from constituent monomers. By exploiting the combination of anisotrophic magnetic susceptibility of LC monomers and a spatially-selective photopolymerization technique, it is possible to independently dictate the molecular alignment and polymerize the structure. First, monomer alignment is directed using a 300mT magnetic field generated using permanent magnets mounted on a rotating stage. A digital micromirror device (DMD) polymerizes desired regions to preserve this orientation voxel-by-voxel; there is no restriction on multiple molecular orientations within a single layer. The monomer can be changed between subsequent layers, introducing functional gradations that can elicit dynamic and varied response profiles in the finished structure. The entire process is carried out at a constant temperature, eliminating in-process deformation and preemptive thermal curing as well as reducing process times. This platform is posed to usher in the next generation of responsive, transformable 3D geometries with microstructural and compositional gradients that until now have proved impossible.			Materials science		Meenakshisundaram	Ravi	Industrial Engineering	Concept	License
	4747	Novel Composite for Atmospheric Condensable Gas Recovery	This novel gel material readily absorbs water from the air and yields the liquid by simple mechanical pressure on the gel. Under typical atmospheric conditions the composite can recover from an ambient gas source nearly half of the water that would have been recovered had it been placed directly in liquid water. This process is passive and requires no external energy input. The gel is created from safe, cheap materials and is easy to produce, and disposal is environmentally and economically friendly. In addition to scavenging atmospheric water, future uses may include to extracting other condensable vapors from gas streams. This composite gel has the potential to revolutionize water access in an era of climate instability and unpredictably changing water supply.			Materials science		Jiao	Shichao	Chem/Petroleum Engineering	Prototype	License
	4488	MiniSTORM: Super Resolution Microscopy at Minimized Cost and Maximized Performance	MiniSTORM is a small, self-contained, portable nanoscope that is comprised of cutting-edge optical elements, sophisticated photoelectric devices, and optimized analysis platforms to achieve state-of-the-art single molecule-level imaging results. Its compact design and highly efficient active anti-vibration system can guarantee its resolution up to 10 nm without the requirement of dedicated room or optical table. Perhaps most importantly, miniSTORM is much more affordable than existing options. At only $35,000, nanoscopy can be accessible at prices over 10 times lower than existing options.	Other		Materials science	Microscopy	Ma	Hongqiang	Med-Medicine	Prototype	License;NewCo
	4277	Additive Manufacturing of Liquid Crystal Elastomers	Liquid crystal elastomers (LCEs) are mechanically-active, stimuli-responsive soft polymers that undergo large, reversible, anisotropic shape change in response to a variety of stimuli, including heat and light. These materials require neither an external load nor an aqueous environment to undergo this change. By controlling molecular orientation using shear forces, LCE shape change can be patterned spatially and hierarchically. Direct-write printing can then be used to print structures capable of being triggered to morph from one state to another. This is a scalable technique that produces 3D structures capable of reversible, untethered, and low-hysteresis shape change, enabling 4D printed materials to operate as autonomous morphing structures capable of reacting to stimuli.			Materials science		Meenakshisundaram	Ravi	Industrial Engineering		License
	4204	Flexible Perovskite Solar Cells	Our new PSC is comprised of a thermally-oxidized titanium foil as a substrate with a transparent electrode top layer. The oxidized titanium lends the PSC flexibility and resiliency, and maintains its original efficiency even after bending 1,000 times. Other methods of flexible PSC creation result in significant breakdown during this same test. The transparent electrode layer functions to shield the oxidized titanium layer from UV light, humidity, and oxygen, ensuring protection from the elements, a significant limitation of current PSC technology. In addition, our flexible PSC reaches a power conversion efficiency of 14.9 percent, which is competitive with traditional polycrystalline thin film panels. With increased fatigue resistance and efficiency, our flexible PSC device solves the major limitations plaguing solar cell technology and makes solar- powered wearable electronics a realistic possibility.			Energy		Lee	Jung-Kun	Mechanical Engineering and Materials Science	Prototype	License
Recently Added	4193	High Transparency, High Haze Nanostructured Glass with Fluid-Induced Switchable Haze	The glass used in optoelectronic devices must function to protect them from the ambient environment while allowing light to pass through and interact with the underlying photoactive layers of the device. Increased haze and transparency of the glass substrates affects how much light scatters into or out of the photoactive layers and can result in improved efficiency. However, current methods used to accomplish this increased light scattering via texturing generally create substrates that are relatively limited in their haze and transparency. Furthermore, the textured glass made contains large surface features that make them impossible to be integrated into optoelectronic devices without added processing steps, thereby increasing the cost of production. Conversely, our nanostructured glass is fabricated through a scalable mask-less one-step reactive ion etching (RIE) process on fused silica glass. It offers high haze and high transparency simultaneously created via a single process, making it an ideal glass substrate to be used in optoelectronic devices.			Materials science		Haghanifar	Sajad	Industrial Engineering	Prototype	License
	4192	Sensors Based on Carbon Nanomaterials	Thanks to their large charge carrier concentration, high surface area, and single-atom thickness, all of which promote sensitivity to surface-level molecular interactions, carbon nanomaterials make ideal sensor transducers. The nanomaterial is composed of holey reduced graphene oxide, which can be decorated with different receptors that confer selectivity depending on the desired application; for example, hydrogen, oxygen, or hydrogen sulfide gas detection. Unlike most commercially available sensors, which require energy-intensive heating elements or sophisticated lab equipment, our platform can be implemented as simple electronic components that change their resistivity based on chemical interactions. Despite its advantages, carbon nanomaterials pose a significant health risk to those exposed through environmental contamination or direct handling. To address this concern, we developed an enzymatic method for safely biodegrading carbon nanotubes. When broken down in this way, nanotubes no longer carry any associated health risk.			Materials science		Ellis	James	Chemistry	Prototype (device) In vivo data (enzymatic degradation)	License
	4097	Nano-Eclipse	The N-LED consists of five layers: a silicon-based electron supply layer, a quantum-dot emissive layer, a polymer hole layer, and an anode layer. When voltage is applied to the supply layer, a dense electron gas is formed at the junction with the next layer. The electrons repel each other and are forced into the next layer above. The turn-on voltage required to achieve bright illumination is very low (~1-2V), and because illumination is greatest at the periphery of each emitter, efficiency improves as size shrinks, encouraging scalability. Nanometer-sized perforations are currently achievable using electron beam lithography and we ultimately expect to generate sub-nanometer LEDs containing a single quantum dot. This technology can be used as a silicon-based single-photon source on demand, which will be important for future quantum information technology.			Semiconductor,MEMS		Kim	Hong	Electrical and Computer Engineering	Light emission and low voltage operation confirmed; currently optimizing hole-spacing and charge-conducting layer to achieve theoretical efficiency.	License
	3655	Using Composite Sealing to Augment Solar Cell Durability and Lifespan	In humid air, ambient water molecules are preferentially adsorbed to an inorganic component below the perovskite layer, resulting in dissociation of an organic component from the lead iodide perovskite solar cell. Researchers have developed a new protective layer which has tunable wettability to prevent the interaction between water and the lead iodide. The protective layer is a nanoparticle-embedded PMMA polymer coating that produces a superhydrophobic film that effectively seals the solar cells from ambient water. It is a cost-effective solution that also has the advantage of being flexible, encouraging the development of flexible solar devices for use in wearable electronic devices, automobiles, and building applications. The new, flexible PMMA coating effectively suppresses the aging of perovskite solar cells and dramatically increases the lifetime of high-efficiency solar cells.			Semiconductor,MEMS		Lee	Jung-Kun	Mechanical Engineering and Materials Science	Prototype	License

Recently Added	3092	Room-temperature Electronically Controlled Magnetism at Oxide Interfaces	Researchers at the University of Pittsburgh have identified a new phase of an oxide heterostructure composed of two insulating oxides LaAlO3 and SrTiO3. This exhibits a novel ferromagnetic phase which is completely electrically controllable and stable at room temperature. By introducing electronics to the interface, the magnetic contrast can be decreased, implying an antiferromagnetic alignment between the magnetic moments and introduced carriers. This coupling is expected to lead to a wide class of magnetically controllable devices, such as spin-torque transfer, spin-polarized electron transport, electrically controlled spin-wave propagation and detection, large magnetoresistance effects, and spin-transistor behavior, all of which are potentially revolutionary information technologies. In addition, it can be demonstrated that very small domain structures can form in this system, which allow for high storage density and electrical readout.	Materials science	Levy	Jeremy	Distinguished Faculty-Dietrich School of Arts and Sciences	Prototype	License
Recently Added	2390	Sensors Based on Carbon Nanomaterials	Thanks to their large charge carrier concentration, high surface area, and single-atom thickness, all of which promote sensitivity to surface-level molecular interactions, carbon nanomaterials make ideal sensor transducers. The nanomaterial is composed of holey reduced graphene oxide, which can be decorated with different receptors that confer selectivity depending on the desired application; for example, hydrogen, oxygen, or hydrogen sulfide gas detection. Unlike most commercially available sensors, which require energy-intensive heating elements or sophisticated lab equipment, our platform can be implemented as simple electronic components that change their resistivity based on chemical interactions. Despite its advantages, carbon nanomaterials pose a significant health risk to those exposed through environmental contamination or direct handling. To address this concern, we developed an enzymatic method for safely biodegrading carbon nanotubes. When broken down in this way, nanotubes no longer carry any associated health risk.	Materials science	Star	Alexander	Chemistry	Prototype (device) In vivo data (enzymatic degradation)	License
Recently Added	1867	Oxide Nanoelectronics On Demand	Researchers at the University of Pittsburgh have developed a novel method of creating nanoscale electronics with the potential to create the smallest electrical devices demonstrated to date while circumventing the need to use more complicated lithographic procedures. This is accomplished by inducing a “polarization catastrophe” that produces a quasi-two-dimensional electron gas at the interface between two polar insulators, LaAlO3 and SrTiO3. Nanoscale conducting regions are created and erased using voltages applied by a conducting AFM probe, which can then create various multi-terminal devices. This writing and erasing process allows for remarkable versatility in the creation of tunnel junctions and field-effect transistors with spatial dimensions comparable to single-wall nanotubes and holds the potential to revolutionize the electrical device market.	Materials science	Levy	Jeremy	Distinguished Faculty-Dietrich School of Arts and Sciences	Prototype	License
Recently Added	1467	Ultrahigh Density Patterning of Conducting Media	Dr. Levy has developed a novel method for using an oxide heterostructure as a “nanoelectronic sketchpad,” suitable for ultra-high-density lithographic patterning of a quasi-2D electron gas. By applying localized electric fields to only 3 unit cells of a polar insulating oxide, an insulator-metal transition is induced with the ability to create localized conducting regions that are useful for ultra-high storage density and information processing, both classical and quantum. All of the functions necessary for information processing, including resistors, capacitors, inductors, and field effect transistors, are all easily fabricated using this method with dimensions as small as 7 nm. On/off states can be made non-volatile, enabling reconfigurable logic devices. The small size of the structures are suitable for use in devices which have a quantum nature, such as single-electron transistors (SETs), which are useful as extraordinarily sensitive charge detectors. This novel method of lithographic patterning could immediately replace magnetic storage materials used in current hard disk drives, a $20B/year industry. It is also possible to integrate these materials with silicon, opening up a new range of uses in nanoscale silicon device technology.	Materials science	Levy	Jeremy	Distinguished Faculty-Dietrich School of Arts and Sciences	Basic elements of high-density storage have been demonstrated, transistor action has been demonstrated, nanoscale-sized wires have been created.	License