



Advanced Materials and Nanomanufacturing Technology R&D Company

Supplement Technical Capabilities & IP

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Opportunity

MJK Partners has been retained by Management and the Board of MicroContinuum, Inc. (MCI) to explore strategic opportunities for the company, including investment, merger/combination, or sale. This is a unique opportunity for a strategic buyer to acquire a highly regarded provider of outsourced R&D services for government and industry with deep expertise in roll-to-roll manufacturing and micro & nanoimprinting.

This document provides an overview of the opportunity. More public information can be found at: <https://mjkpartners.com/opportunities/microcontinuum/>

Additional information about the details of the company's operations, people, products and technology is available once an NDA is executed.

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Contents of this Supplement

MicroContinuum possesses unique expertise and capabilities in the area of advanced materials and roll-to-roll nanomanufacturing. The following slides provide additional information covering:

- Applications
- Technical Capabilities
- Process Capability Clusters
- Intellectual Property

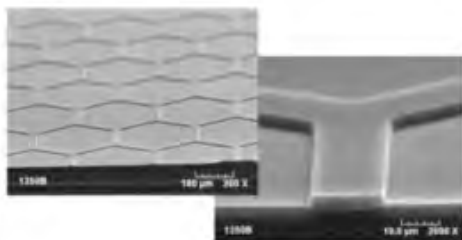
The company is available to discuss these capabilities in more detail with interested parties.



Applications for MCI Capabilities

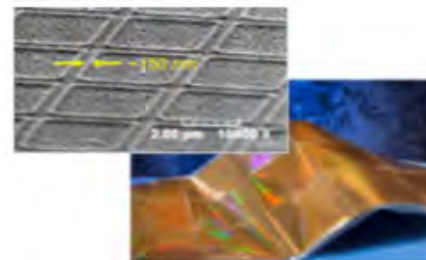
Transparent Conductors

Low-cost patterned films for electronic devices and OLED lighting.



Nanoantenna

Fabrication of nano-scale antennas and terahertz electronics for energy harvesting and THz-wave detection.



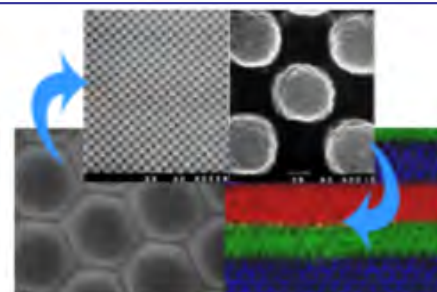
Flexible Electronics

Thin-film transistors and circuit components on plastic films for rollable displays, electronics and sensor networks.



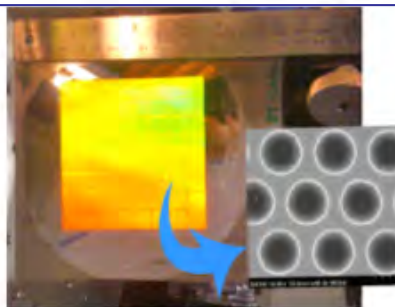
In-Line R2R Processing

Growth and harvesting of arrays of custom-shaped particles for chemical, biological and sensor/detection applications.



Photovoltaics

Use of nanopatterned substrates in solar cells for improved efficiency and reduced costs.



Optical Data Storage

Roll-to-roll nanoforming and thin-film vacuum coating to produce extreme capacity archival data storage media.



Selected Technical Capabilities

- Roll-to-roll and batch micro and nanoimprinting
- Metal and non-metal patterning
- Patterning on textured and/or curved surfaces
- Direct room-temperature imprinting into polymer films
- Forming in-situ flexible photoresist masks
- Complex patterned multi-layer films
- Precise transfer of complex patterns between substrates
- Low cost plastic imprint tools
- Forming, filling and sealing micro-vessels
- Roll-to-roll and batch vacuum coating
- Roll-to-roll pilot scale imprinting
- Producing microfluidic channels with nanoporous surfaces



Process Capability Clusters

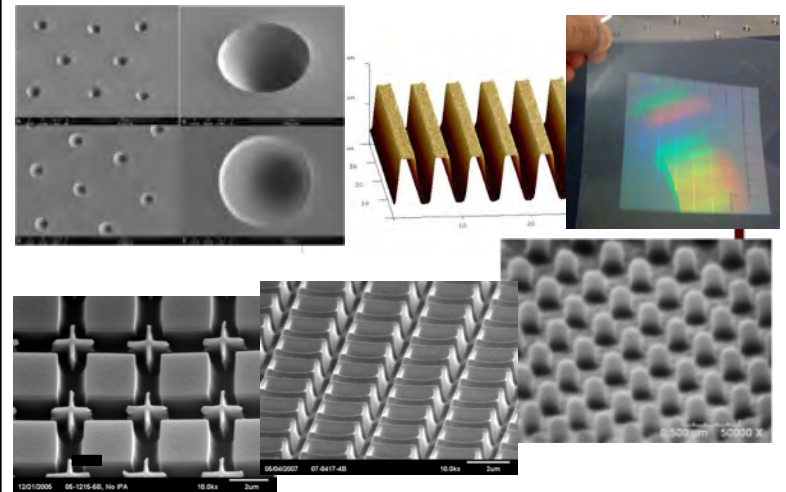
1. Precision 3D micro- and nanostructures
2. Metal patterns on film, foils, paper and glass
3. Roll-to-roll pilot manufacturing
4. Building complex multi-layer structures
5. Manipulation of 2D/3D layers
6. Patterning rigid, flexible and stretchable substrates
7. Roll-to-roll and batch vacuum deposition



Precision 3D Micro- and Nanostructures

Technical Capabilities

- ✓ High-resolution structures over large areas
 - feature sizes $<25\text{nm}$ to $>100\mu\text{m}$
 - aspect ratios from $<1:1$ to $>10:1$
- ✓ Our *Advanced Surface Nanoforming* offers direct imprinting into Zeonor, polycarbonate, PMMA, CAB, etc.
- ✓ Substrates: polymer films, metal foils, glass
- ✓ Substrate shapes: flat, curved, convex, concave
- ✓ Substrate thicknesses: $<5\mu\text{m}$ to $>500\mu\text{m}$



Projects & Customers

- Optical tape for archival Cloud storage
 - Oracle
- eBook light control films
 - Amazon/Lab126/Saint-Gobain
- Diffractive optics on curved surfaces
 - Google
- optic fiber diffuser array
 - Qualcomm
- precision light diffuser
 - Oculus

Relevant IP

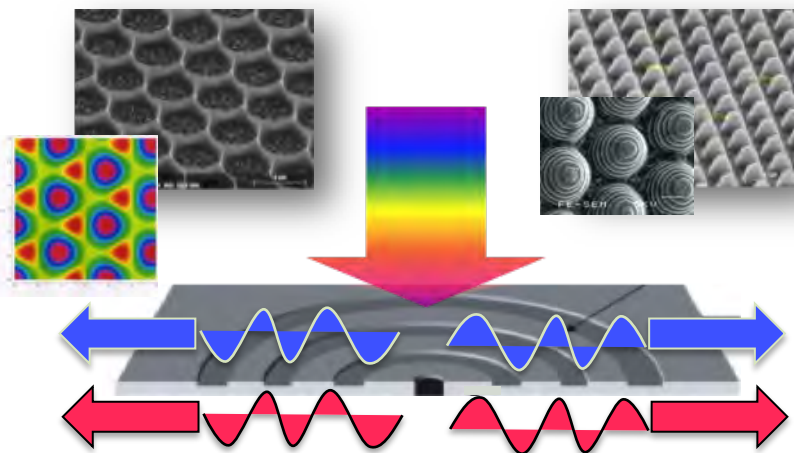
- | | |
|--------------|--|
| US9079349B2 | Methods for forming patterns on curved surfaces |
| US7833389B1 | Replication tools and related fabrication methods and apparatus |
| US7674103B2 | Replication tools and related fabrication methods and apparatus |
| US8940117B2 | Methods and systems for forming flexible multilayer structures |
| US9039401B2 | Formation of pattern replicating tools |
| US8435373 B2 | Systems and methods for roll-to-roll patterning |
| US9724849B2 | Fluid application method for improved roll-to-roll pattern formation |
| US8845912B2 | Tools and methods for forming semi-transparent patterning masks |
| US9307648B2 | Roll-to-roll patterning of transparent and metallic layers |



Patterned Metal Films

Technical Capabilities

- ✓ Transparent high-conductivity metal films
 - *electrical conductivity* $<5\Omega/\text{sq}$
 - *optical transmission* $>95\%$
 - *continuous surface conductivity*
 - *low cost*
- ✓ Electrodes for TFT backplanes and flexible electronics
- ✓ Terahertz nanoantenna films for waste heat harvesting



Projects & Customers

- metal mesh transparent conductors
 - *Dept. of Energy*
 - *Philips Lighting*
 - *Universal Display*
 - *FlexTech Alliance/USDC*
- selective metallized light directing films
 - *Qualcomm*
- waste-heat to electricity
 - *RedWave Energy*

Relevant IP

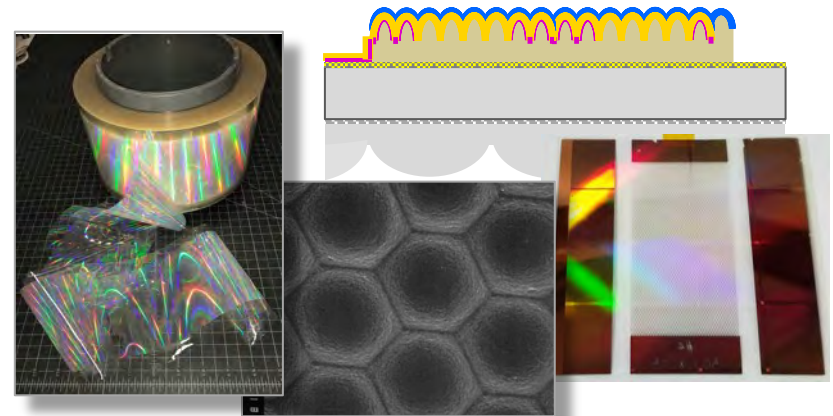
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US8940117B2	Methods and systems for forming flexible multilayer structures
US9039401B2	Formation of pattern replicating tools
US8535041B2	Addressable flexible patterns
US9589797B2	Tools and methods for producing nanoantenna electronic devices
US8435373 B2	Systems and methods for roll-to-roll patterning
US9724849B2	Fluid application method for improved roll-to-roll pattern formation
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US9307648B2	Roll-to-roll patterning of transparent and metallic layers



Roll-to-Roll Pilot Scale-Up & Processing

Technical Capabilities

- ✓ Precision 3D nanoscale patterns on ultra-thin to thick substrates
- ✓ Diffractive and holographic optical films
- ✓ Imprinted edge-lit light control films
- ✓ Continuous flexible nanomolds for shaped pharmaceutical nanoparticles



Projects & Customers

- R2R manufacturing of integrated enhanced OLED substrates
- Archival Cloud optical tape storage
 - Oracle
 - Sun Microsystems
 - US Department of Energy
- R2R Patterned films for drug delivery
 - Liquidia Technologies
 - SQZ
- R2R diffraction gratings in education
 - Learning Technologies
 - Science First

Relevant IP

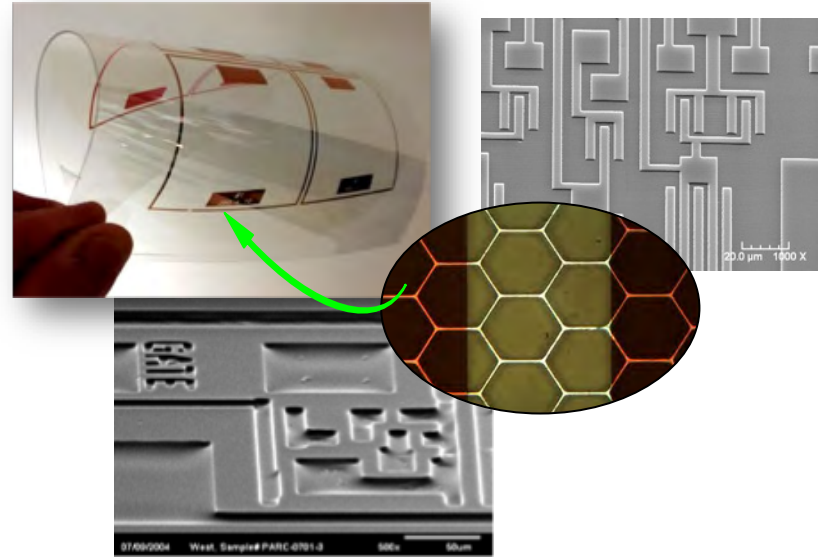
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Building Complex Multi-Layer Structures

Technical Capabilities

- ✓ Films with multiple integrated functionalities:
 - transparent metal mesh conductors
 - nanoscale extraction layers
 - microlens arrays
- ✓ 'Buried' metal conductors flush with surface
- ✓ Developed for wide range of substrate types:
 - plastics, metal foils, glass
 - <math><5\mu\text{m}</math> to $>500\mu\text{m}$ thickness range
 - transparent or opaque
 - flexible or rigid



Projects & Customers

- Converting waste heat into electricity
 - *RedWave Energy*
- Integrated enhanced OLED substrates
 - *US Department of Energy*
 - *EERE/Iowa State University/Ames Lab*
- Large-area flexible electronics
 - *DARPA/MacroE/UCFLA*
 - *SRI/Sarnoff Corporation*
- Flexible TFT backplane
 - *PARC*

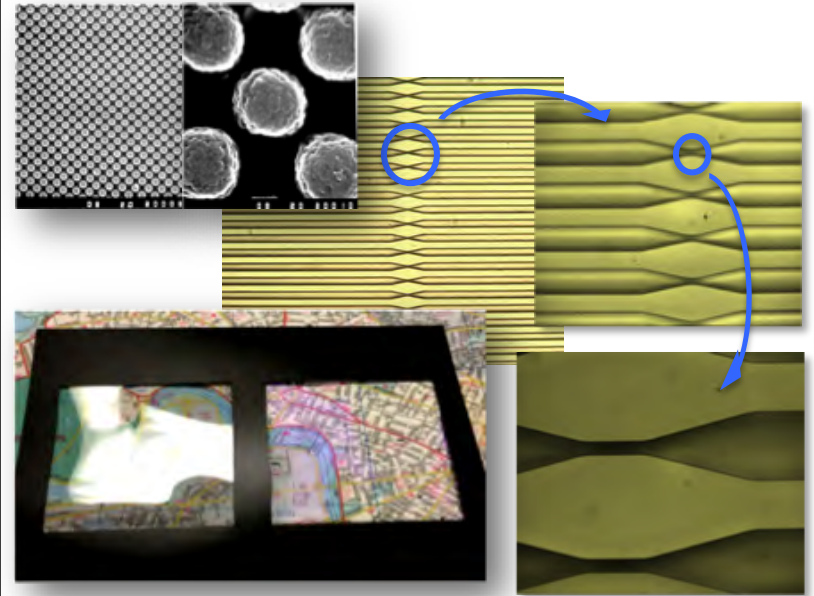
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Manipulation of 2D/3D Structures & Layers

Technical Capabilities

- ✓ Transferring complex patterns from 'donor' sheet to 'receiver' sheet
 - isolates 'receiver' film from 'donor' processing environment
 - retains exact layout of features
- ✓ Conformal 3D metal patterns
- ✓ Metal patterns and polymer structures on lenses
- ✓ Microfluidic structures with nanopore filtration channels



Projects & Customers

- Lab-on-chip nano-filtration
 - *Draper Laboratories*
- Motheye anti-reflection surfaces
 - *Triton Systems*
- Nanoparticles in microwells
 - *nanoComposix*
- Biomimetic (gecko) adhesives ('Zman')
 - *Draper Laboratories*
- Drug delivery
 - *SQZ*
 - *Liquidia Technologies*

Relevant IP

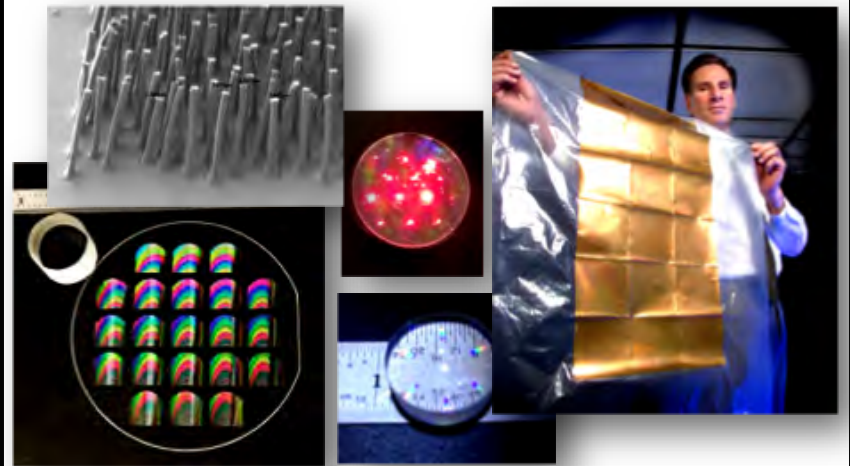
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Substrates: Rigid, Flexible and Stretchable

Technical Capabilities

- ✓ binary, diffractive, holographic optics on flat, cylindrical and compound surfaces
- ✓ stretchable optical structures
- ✓ lenses with metal and dielectric patterns
- ✓ high aspect ratio polymer nanofibers
- ✓ frequency selective surfaces



Projects & Customers

- Binary optical elements on curved lens
 - *Google*
- Motheye anti-reflection layer on concave/convex lenses
 - *Triton Systems*
- IR cloaking films
 - *Idaho National Laboratory/ CREOL*
- High-resolution IR sensors
 - *DOD: Army Research Laboratory/Missile Defense Authority*
- RGB polarization filters for digital projectors
 - *RealD/Colorlink*
- Low-cost (wire-grid) polarizer
 - *TRAM, Inc.*

Relevant IP

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Roll-to-Roll and Batch Vacuum Deposition

Technical Capabilities

- ✓ sputtered metals (DC magnetron) and dielectrics (RF magnetron)
- ✓ single and multi-layer films
- ✓ conductive oxides, fluoropolymers and phase-change alloys
- ✓ additive and subtractive photomask (imprinted) processing



Projects & Customers

- Archival cloud storage
 - Oracle
 - Sun Microsystems
- Optical storage ID cards
 - LaserCard Systems
- Solid-state memory chip
 - Hewlett Packard
- Petabyte optical tape
 - US Department of Energy
- High capacity optical floppy disc
 - Polaroid Corporation

Relevant IP

US7369483B2	Pre-formatted linear optical data storage medium
US7833389B1	Replication tools and related fabrication methods and apparatus
US7674103B2	Replication tools and related fabrication methods and apparatus
US9039401B2	Formation of pattern replicating tools
US8435373 B2	Systems and methods for roll-to-roll patterning
US9724849B2	Fluid application method for improved roll-to-roll pattern formation
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US9307648B2	Roll-to-roll patterning of transparent and metallic layers

Intellectual Property

- 14 granted US patents
- 7 foreign patents
- 13 pending or published US applications

US Patent	Title
8535041	ADDRESSABLE FLEXIBLE PATTERNS
9724849	FLUID APPLICATION METHOD FOR IMPROVED ROLL-TO-ROLL PATTERN FORMATION
9039401	FORMATION OF PATTERN REPLICATING TOOLS
8940117	METHODS AND SYSTEMS FOR FORMING FLEXIBLE MULTILAYER STRUCTURES
9079349	METHODS FOR FORMING PATTERNS ON CURVED SURFACES
7369483	PRE-FORMATTED OPTICAL DATA STORAGE MEDIUM
7674103 7833389 8062495 9395623	REPLICATION TOOLS AND RELATED FABRICATION METHODS AND APPARATUS
9307648	ROLL-TO-ROLL PATTERNING OF TRANSPARENT AND METALLIC LAYERS
8435373	SYSTEMS AND METHODS FOR ROLL-TO-ROLL PATTERNING
8845912	TOOLS AND METHODS FOR FORMING SEMI-TRANSPARENT PATTERNING MASKS
9589797	TOOLS AND METHODS FOR PRODUCING NANOANTENNA ELECTRONIC DEVICES



Areas of IP coverage

MicroContinuum has patents as well as trade secrets and know-how that cover methods and systems for:

- creating complex micro- and nanostructures
- embedded metal traces
- fabricating nanoimprint tools
- forming complex multi-layer structures
- improved OLED substrates
- nano/micro patterning on convex/concave lenses
- novel patterning masks
- novel polarizing films
- optical data storage systems
- polarized graphics and displays
- R2R micro- and nanopatterning
- transferring complex and multi-level patterns
- transparent metallic conductors



NOTICE

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