
Rockwell Scientific Company (RSC) Technologies for Data in the Optical Domain

DARPA Data in the Optical Domain Workshop
March 18, 2003

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Rockwell Scientific Company
Thousand Oaks, CA



Rockwell Scientific Company (RSC)

- **Formerly Rockwell Science Center**

- 40 years of R&D heritage
- Multi-disciplinary technologies: Electronics, Optics, Imaging, Materials, Information Sciences

- **Independent and privately-held**

- Owners: Rockwell Automation & Rockwell Collins
- Independent since June 2001

- **Total staff: ~ 450**

- **Main activities**

- Contract R&D in multiple technologies
- Specialty product sales
- Licensing



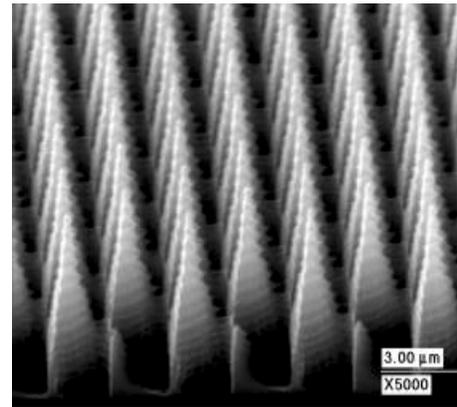
Thousand Oaks, CA



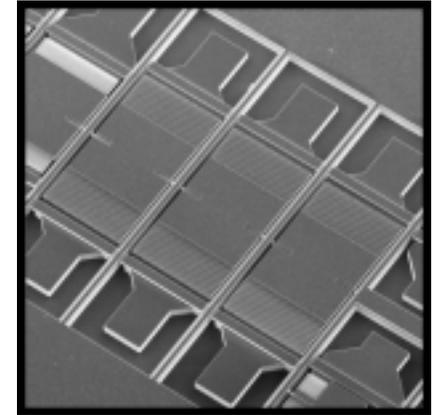
Camarillo, CA

MEMS and Micro-optics

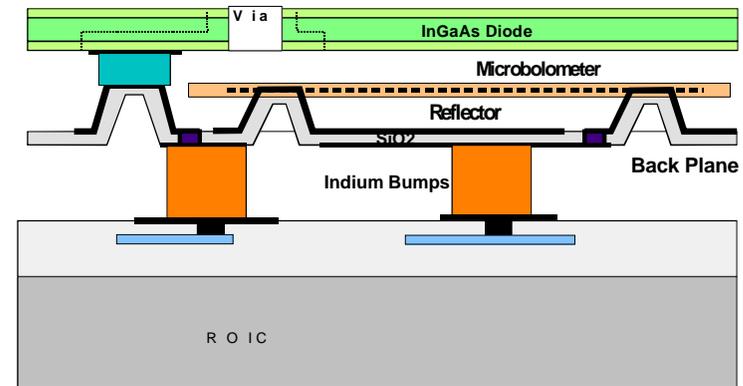
- **High resolution etch capabilities enables precision control of surface optical properties**
- **Aggressive effort in high-performance micro-optic technology**
 - Addressing broad applications: Telecom, Aerospace, Biomedical, Consumer
 - Compatible with MEMS integration
- **Scanning micromirrors**
 - High manufacturing yield (>90%)
 - Low actuator voltage (< 20V)
- **3-D micromachining enabled vertical integration**
 - Unique multi-technology integration
 - Transferred thin-film process to mitigate process incompatibilities
- **Demonstrated integration of MEMS and GaAs semiconductor processes**



Motheye antireflective surface



Scanning micromirrors for DWDM



Uncooled imager technology achieves dual band operation through vertical integration

Advanced Optical Technologies

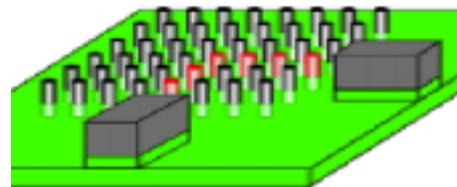
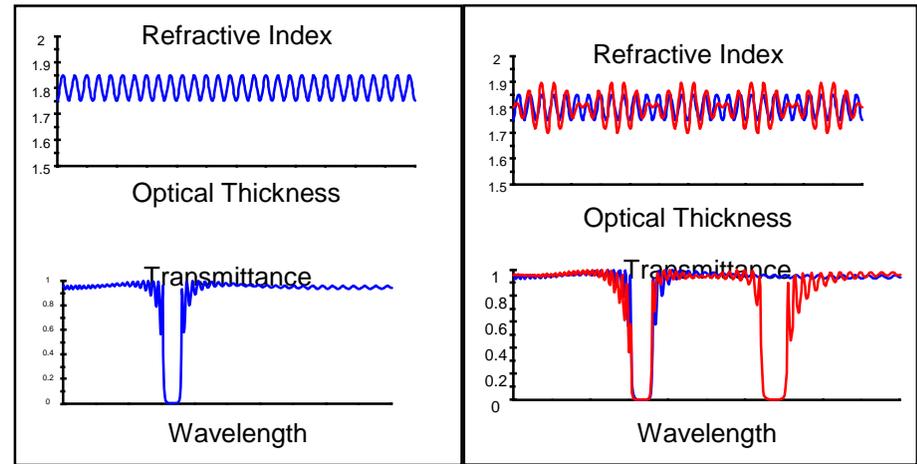
- **RSC is the technology leader in rugate and related developments**

- Sinusoidal index profile(s)
- Powerful method for spectral control
- Suitable for non-conventional WDM
- Physics of rugates is related to (1-D) photonic bandgap materials

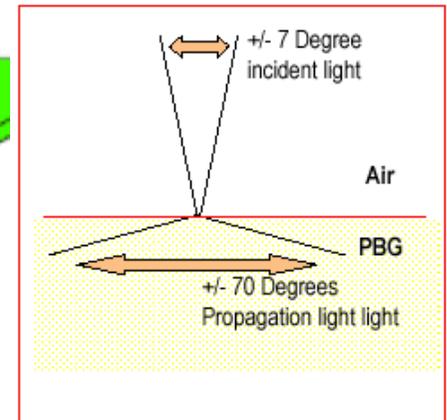
- **Substantial history of RSC efforts in photonic bandgap materials**

- PBG superprism phenomenon will enable integrated microlightwave circuits for agile beam steering, WDM filtering, dispersion compensating
- Innovative monolithic tunable PBG on InP and GaAs substrates based on semiconductor devices and MEMS at microwave regime
- Collaborations with Universities (MIT, UCLA)

- **Applications (including WDM) drive RSC materials efforts**



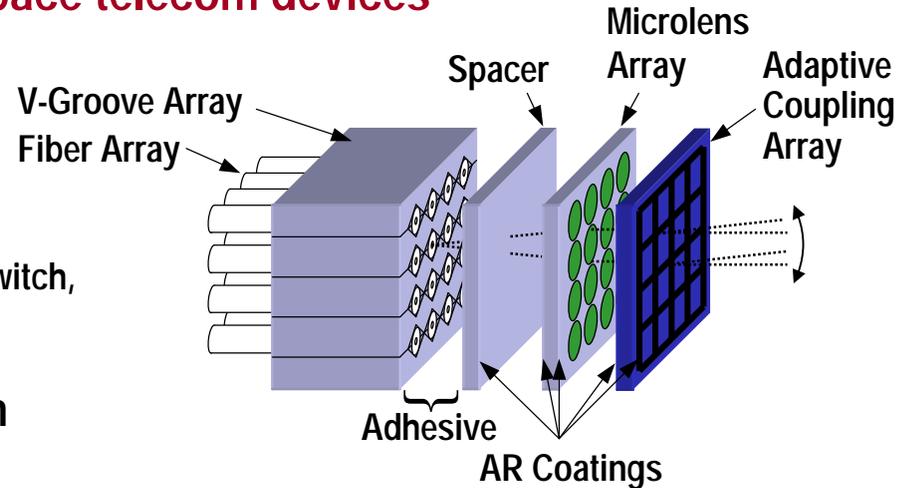
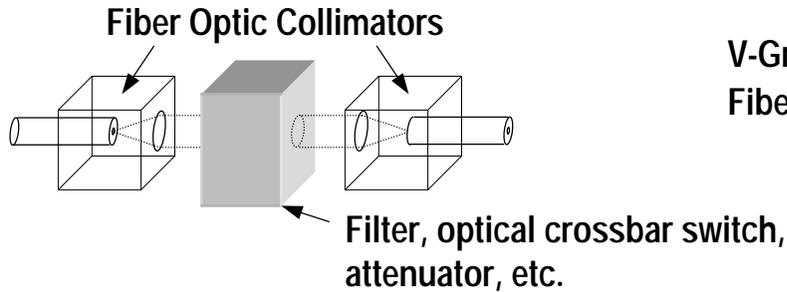
Beam steering by Angular Super-dispersion



Liquid Crystal Technology

- Enabling Components in Low-Cost Telecom Devices

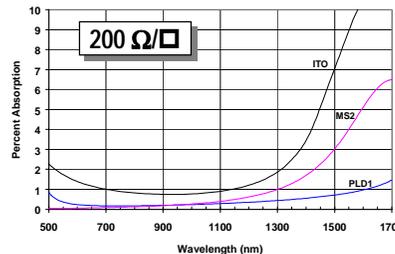
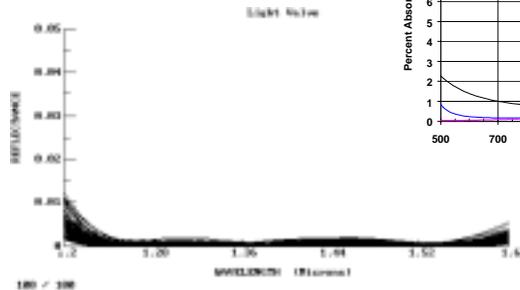
- **Fiberoptic collimator arrays for free-space telecom devices**



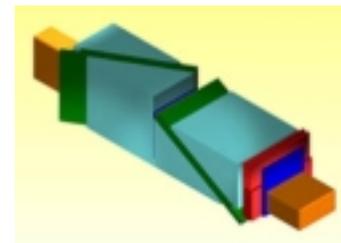
- Array configurations \Rightarrow Cost Reduction

- **Tunable Filters:**
- **Optical crossbar switches: 1x4, 4x4, etc.**

Transparent Conductors



4x4 Full-Duplex Optical Crossbar Switch



Concluding Remarks

- **Multi-disciplinary RSC technologies for Data in the Optical Domain:**
 - MOEMS, Photonics, Advanced Semiconductor technologies, Rugates, Cavity Filters, Micro-optics, Liquid Crystal Components
 - Previous contributions include: OFCS, ONTC, NTONC, WEST, STAB
 - Key technology partnerships (e.g., Conexant, Boeing, Universities)
- **RSC activities range from basic R&D to (selected) low volume production ---- <http://www.rockwellscientific.com>**
 - Interested in developing all-optical domain technologies for fiber optic and free space comm
 - Interested in chip-scale integration of various promising technologies
 - RSC efforts emphasize state-of-the-art and new approaches (e.g., MOEMS, PBG, Liquid crystal components)