Value Addition through Advanced Functional Colorants

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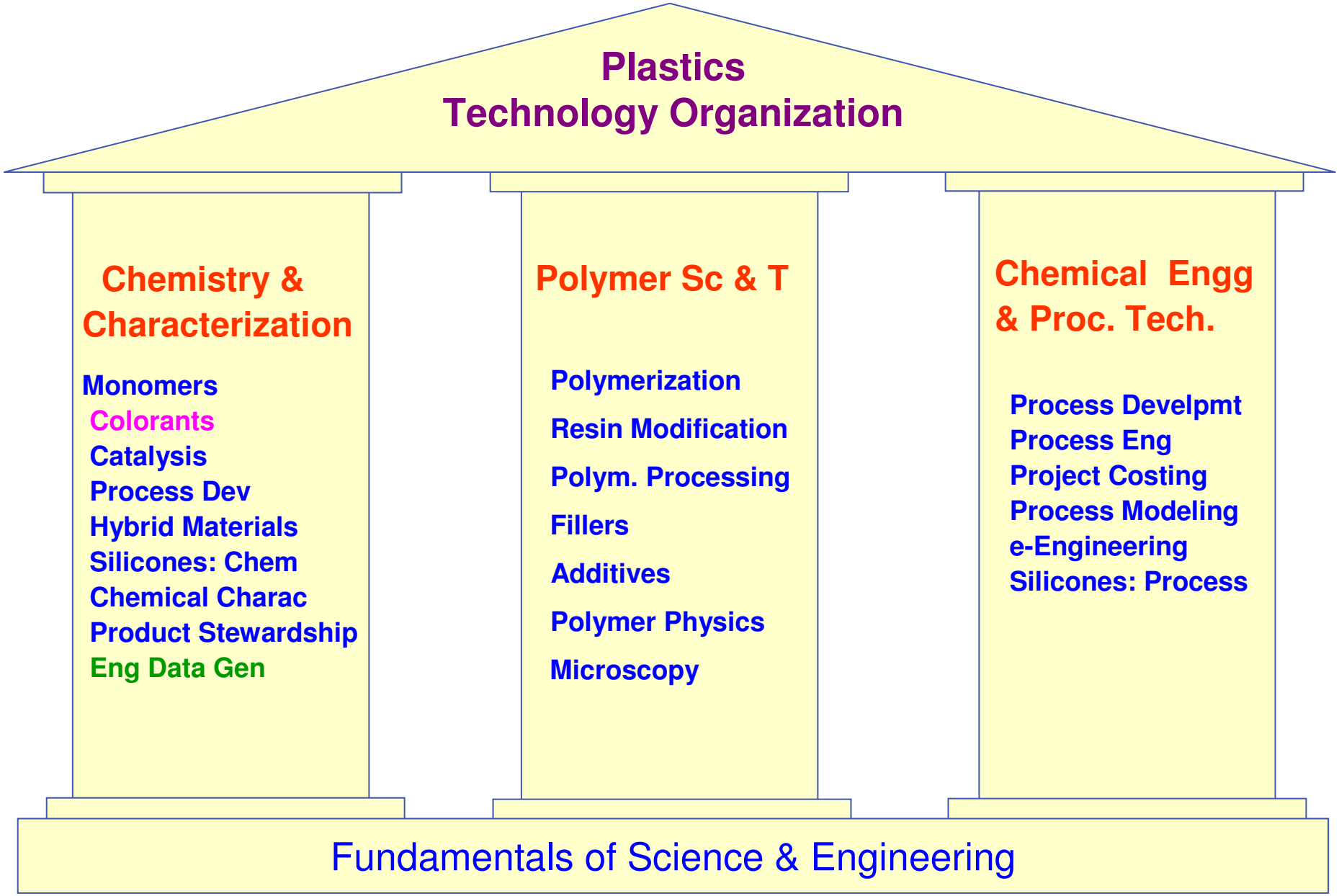

Plastics
Technology Organization
Chemistry & Characterization
Monomers
Colorants
Catalysis
Process Dev
Hybrid Materials
Silicones: Chem
Chemical Charac
Product Stewardship
Eng Data Gen
Polymer Sc & T
Polymerization
Resin Modification
Polym. Processing
Fillers
Additives
Polymer Physics
Microscopy
Chemical Engg & Proc. Tech.
Process Develpmt
Process Eng
Project Costing
Process Modeling
e-Engineering
Silicones: Process
Fundamentals of Science & Engineering

A wealth of experience…..

From premier institutions….

UNIVERSITY OF CAMBRIDGE · CORNELL · PURDUE · University of Connecticut · RUTGERS · National Chemical Laboratory · PENNSTATE · Indian Institute of Technology · UNIVERSITY OF MINNESOTA · IISc

….. and leading organizations…..

COLGATE-PALMOLIVE COMPANY · BASF · Bristol-Myers Squibb Company · Ciba · Clariant · LUPIN · DR. REDDY'S · BRUKER · Johnson&Johnson · Unilever · MERCK · Biocon

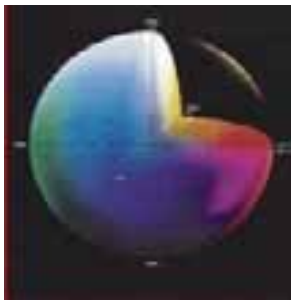
….. across various poles

Diversified Team with Global Experience

imagination at work

Colors at WTC

2007



Design of Functional Colors

Photovoltaics

Holographic Data Storage

Security Applications

Limited Play DVD

Traditional color design

2000

Limited Play DVD

A Chemistry Based Solution to a Consumer Need

"This DVD will self-destruct in 48 hours." This could be the warning message on a new type of DVD to be launched ….."

GE PLASTICS PLAYS ON WITH LEXAN
A patented LEXAN® polycarbonate co-polymer from GE Plastics has a major role in a limited play time DVD from Flexplay Technologies of New York.

Limited Play DVD - Concept

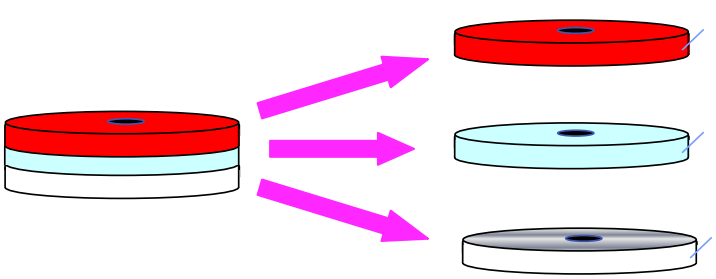
DVD Movie

Playable

Time

O_2

Unplayable

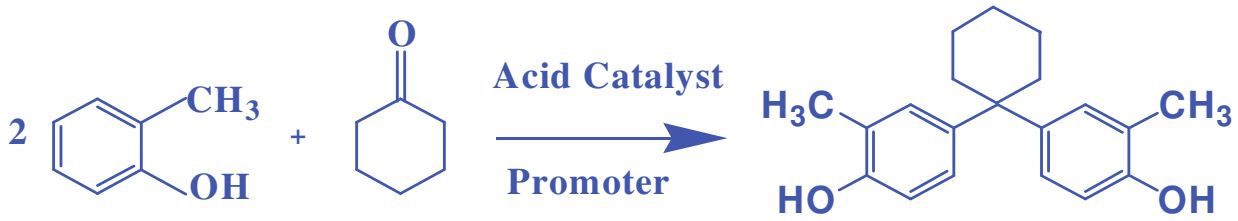


DVD half w/Protective dye(s)

Adhesive/Reactive Dye

DVD half w/ metal layer

DMBPC MONOMER



p,p-DMBPC

- Incorporation as co monomer with BPA in resin .

PACKETS
July 2002

500 Kg (DRUMS)
August 2002

5000 Kg
September 2002

10000 Kg (SUPER SACKS)
December 2002

Commercialization in Record Time

Security Applications - Potential Markets

Telecom
- Battery Casings
- A-covers

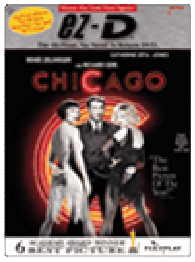
Packaging
- Liquors
- Cigarettes

Business Eqpt.
- Computer Hardware
- Inkjet Cartridges

Broad Variety of Applications & Needs

Homeland Security
- Passports
- ID Cards & Badges
- Luggage tags

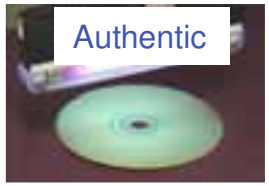
Media
- CD/DVD
- Video Games

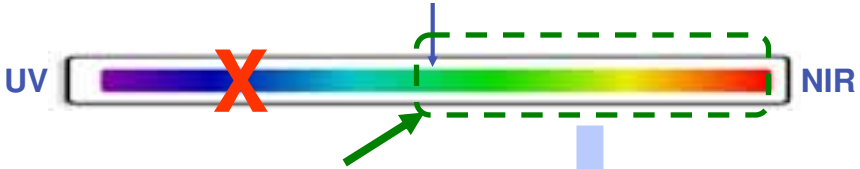


Healthcare
- Drug Packaging
- Medical Devices

Potential Chroma change based solutions

Colors for Optical Media Security Applications





Need a Gamut of UV fluorophores

WTC team

Long Stokes Shift Fluorophores

Compound	λ_{abs} (cut-off)	λ_{max} (FL)	Stokes Shift
A	418	555	191
B	395	542	187
C	387	492	164
D	400	528	185

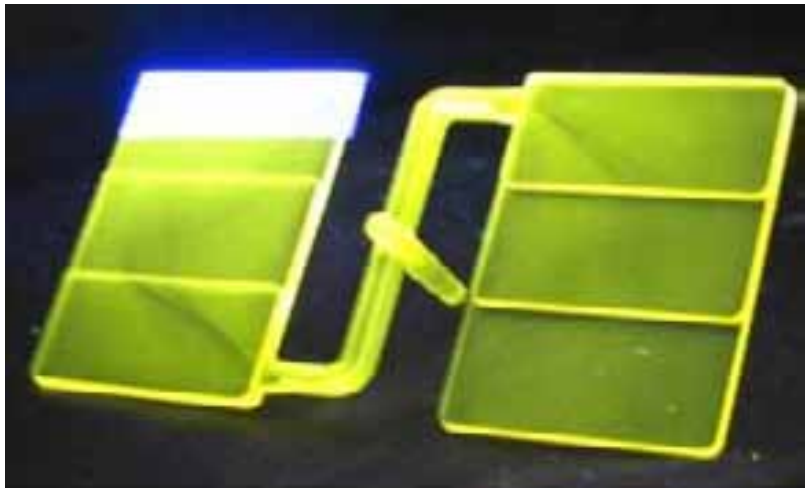
Additional findings:

- Protected fluorophores that could be irreversibly deblocked by heat or light

imagination at work

Over 70 fluorophores prepared

Security Dyes: Long Stokes shift Fluorophores



Holographic Data Storage

imagination at work

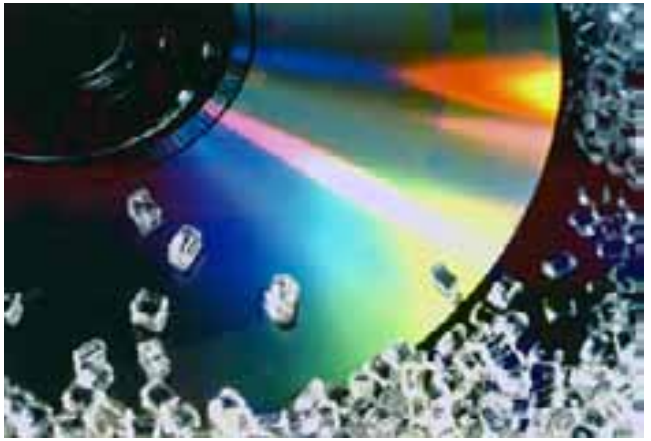
Optical Data Storage @ GE

GE Invented polycarbonate in the 1950's

GE selling polycarbonate into optical media since mid 1980's

In 2004 GE sold > 250MM lbs. Of PC

Generating significant revenues

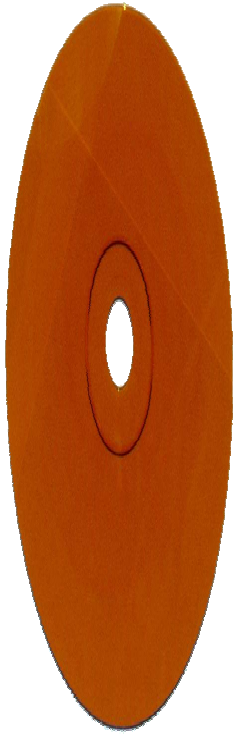


The Challenge:
How do we position GE for what's next?

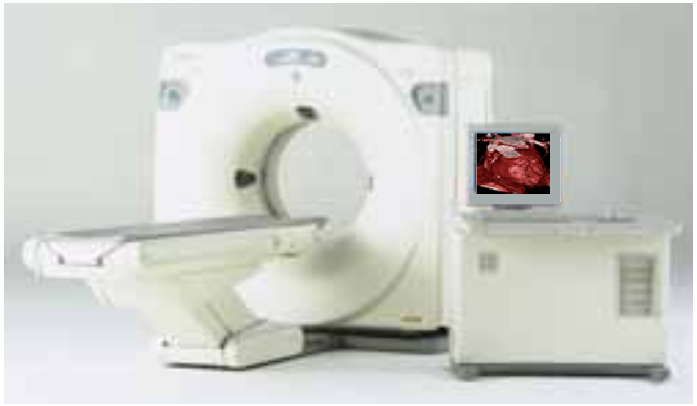
The Digital Age

"640K ought to be enough for anyone." - Bill Gates, 1981

7 - 10 Mpixel → 15 MB/image



2 hours HDTV → 25 GB
2 hours 4K2K → 100 GB



1 week → > 2 TB of image data

3 hours → 10 TB of sensor data

Digital Technology drives storage demand

Ultra-high Definition TV

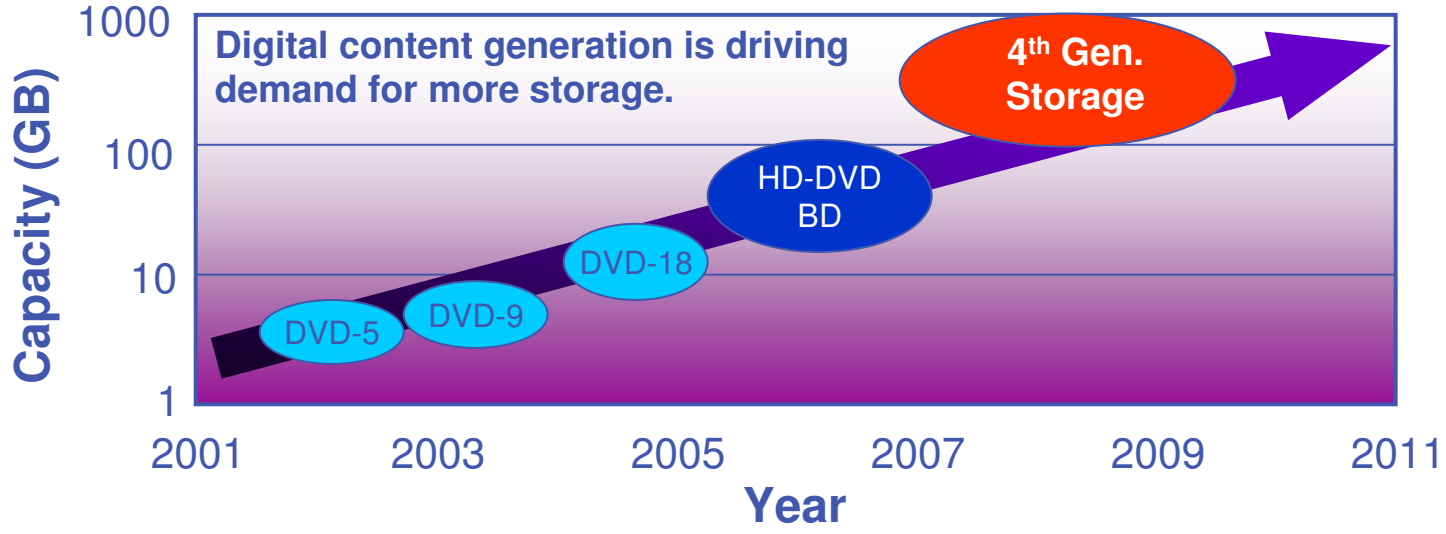
Just in case you thought HDTV had gone far enough…

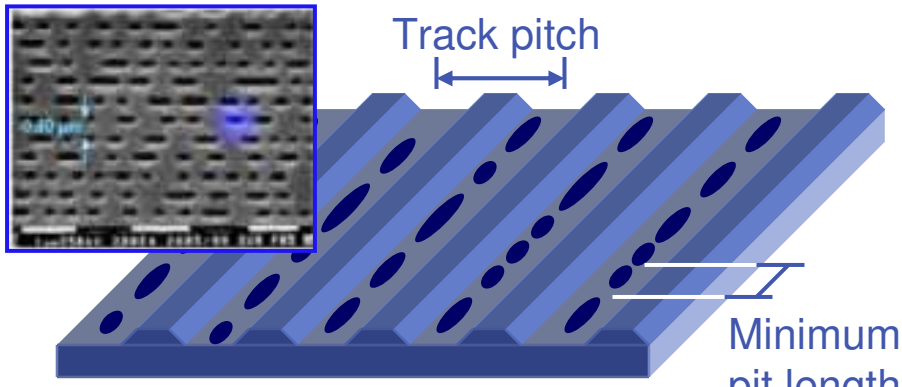
SONY SXRD 4K2K video projector
(started shipping September 2005)

Resolution: 4096 x 2160
Requires **100 GB** for 135 minutes of full resolution video

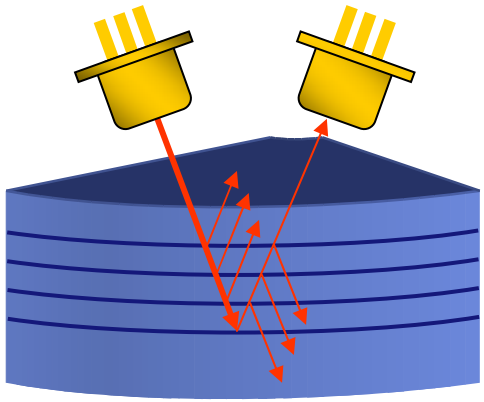
Ultra-high resolution formats on the horizon…what about 4K4K?

Holographic Data Storage





Track pitch & pit length ∝ I

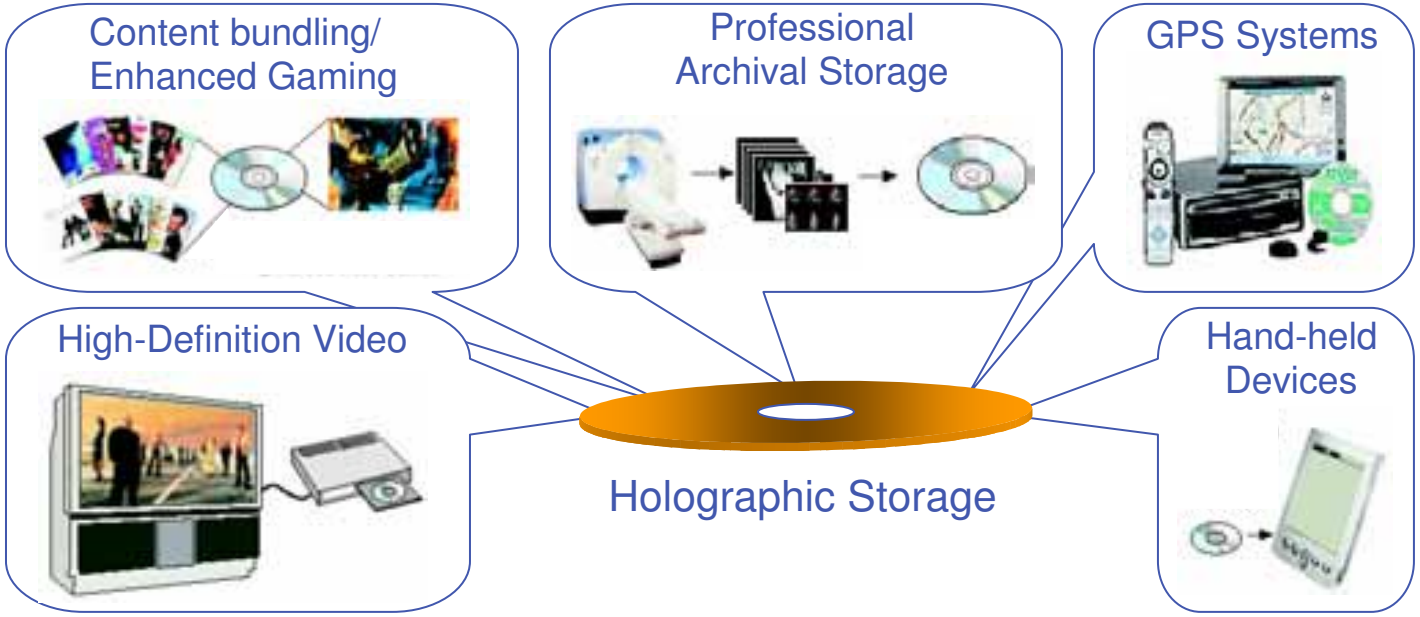


Layers limiting factor

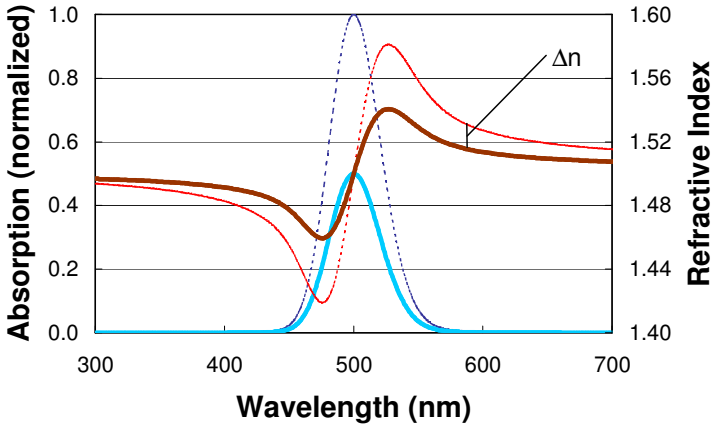
New technology will be needed to meet growth in storage capacity demand

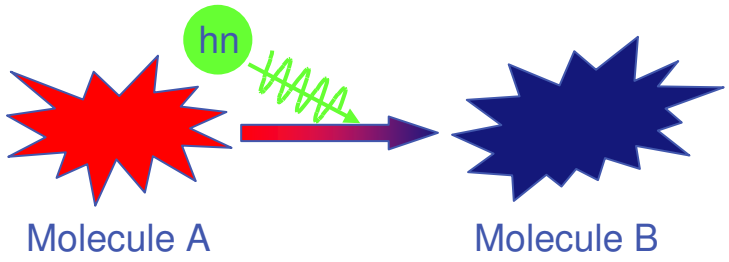
imagination at work

Holographic Data Storage



"Narrow-band" dyes generate refractive index change in thermoplastic media

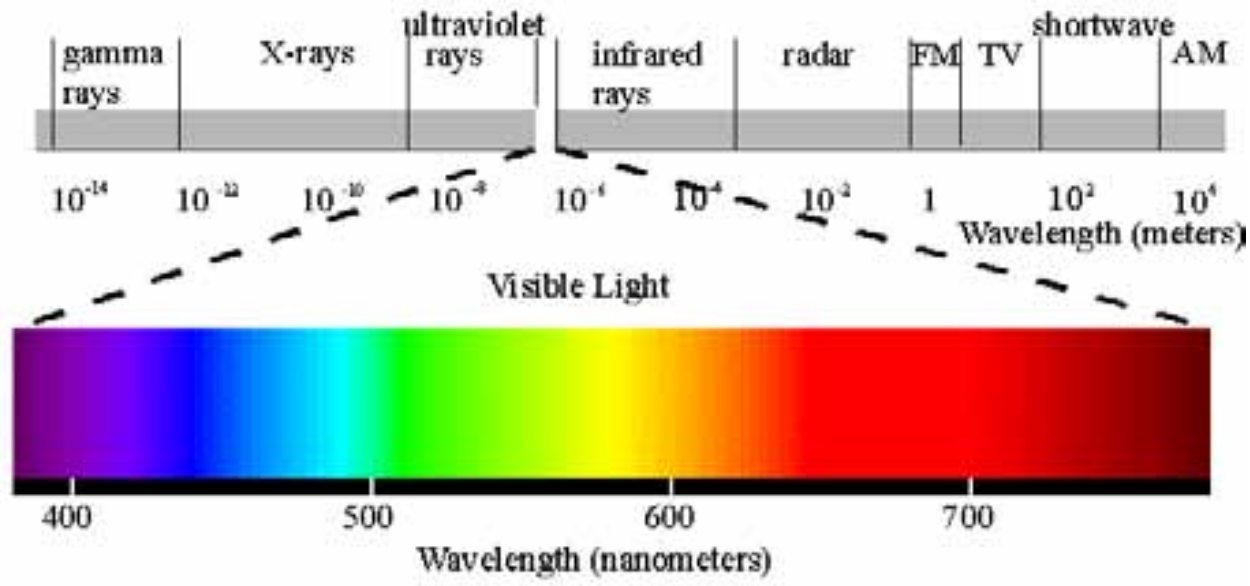




$a_A \neq a_B$
$n_A \neq n_B$

Colors: Going Beyond Tradition……

Traditional, 2nd Source, Impurity Tol.	Weatherables Flexplay Process Dev	Flexplay DVD High-heat Weatherables	Security SLX Flexplay CD	Holographics Security SLX
2001	**2002**	**2003**	**2004**	**2005**



- Interaction of **Electromagnetic Waves** with **Matter**
- Interface of **Chemistry** with **Physics/Electronics**

Some non traditional means of Chroma Change

- Ultrasound
- Rf Voltage
- Gamma Rays
- Electrochemical
- Raman
- Photo-bleachable nano-composites
- ……..

Leading Technologies for the 21st Century

Thank You