Anti-counterfeiting and identification for and with organic and bio materials

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Fight against fraud

Cigarette smuggling… counterfeiting of pharmacological products… evasion of import duties on shoes and clothes… subsidies for growing oranges on farms that don't exist, false medical implants – all are examples of fraudulent activities that cost European taxpayers money

Fraud and related corruption is estimated to cost the EU economy €120 billion per year, just a little less than the annual budget of the European Union

Europe and all advanced Countries need an effective
anti-fraud policy, but before that they need
simple, effective and affordable novel technical solutions
for **anti-counterfeiting, authentication, identification and traceability**
for **health, justice, logistics, industry, …**

Today solutions

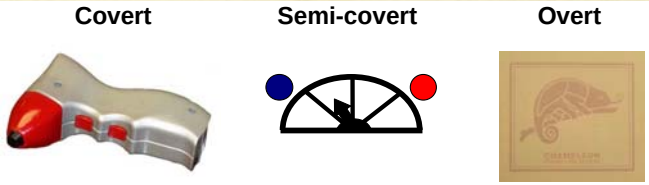
Overt layers are readily apparent to the authenticating party:
- Color shifting inks
- Pearlescent inks
- Visible holograms
- Watermarks

Semi-overt layers require foreknowledge and action
- Termochromic inks
- Coin reactive inks
- Photochromic inks
- Chemical markers
- Micro printing

Covert layers are the most advanced solutions:
- UV responsive materials
- IR responsive materials
- Magnetic inks
- DNA based taggants
- Machine readable taggants.

Soft and bio materials are suitable for all kinds of these technological approaches.

Taggants/readers are promising systems for simple covert authentication and soft and bio materials can provide a rich range of novel solutions.



Layered Authentication Solutions

Track and Trace Solutions

Soft and bio nano-materials

Nanotechnologies offers solutions for traceability and product and material authentication and identification

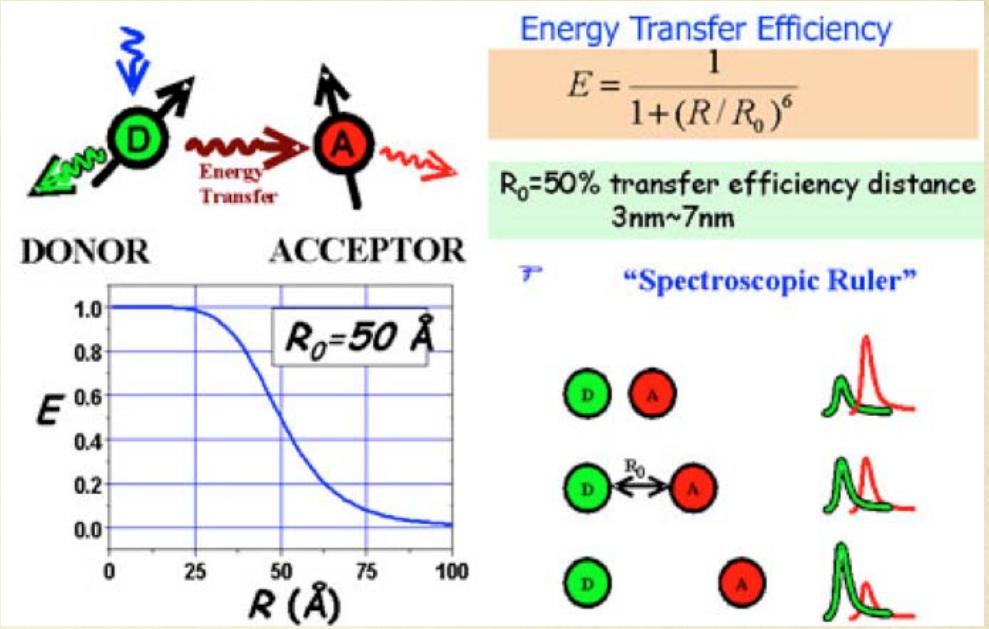
Soft and bio materials are the best candidates for novel solutions:

- Smart materials
- Photonic nano devices
- Optical nano-spectroscopy
- Molecular encryption
- Molecular and spectroscopic cryptography
- Nanotechnological taggants
- Novel overt and covert taggants
- …

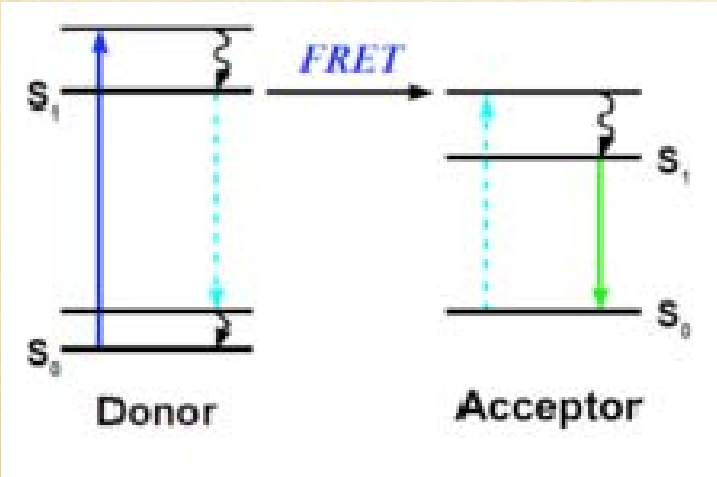
An example: smart ink using FRET

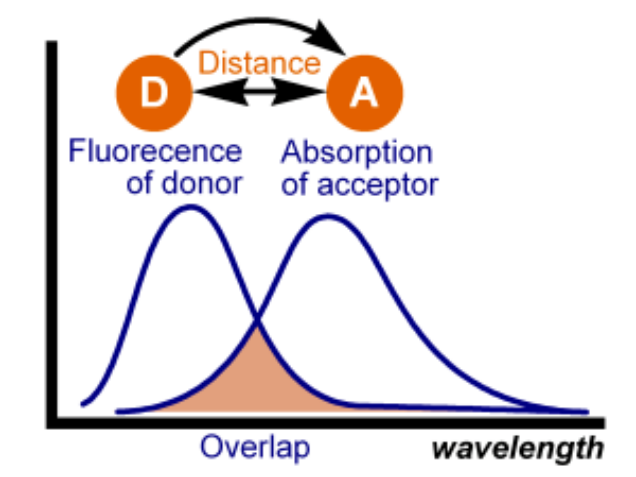
Today the main methods of recognition for inks are based on:

- Direct fluorescence techniques (UV-VIS)
- NIR absorption
- Bragg reflection
- Electrical measurements
- Magnetic properties



A novel approach: **FRET, Fluorescence Resonance Energy Transfer**

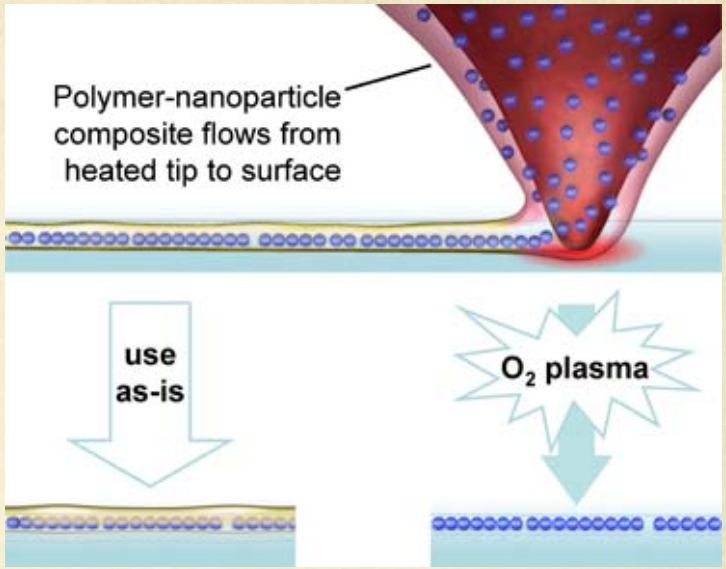


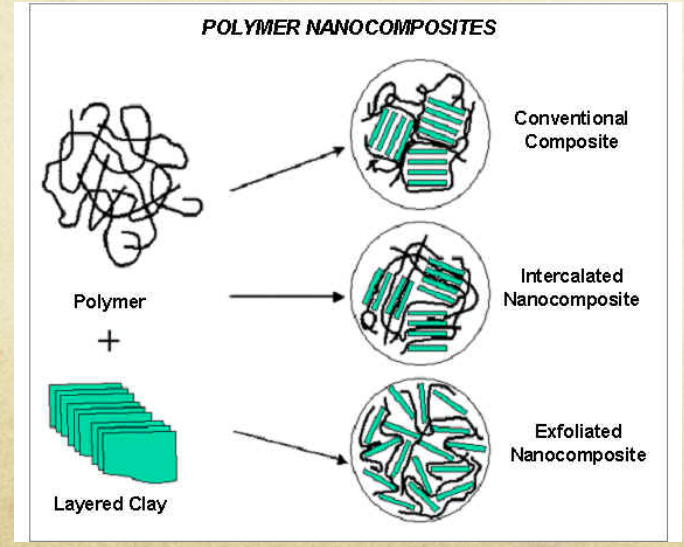


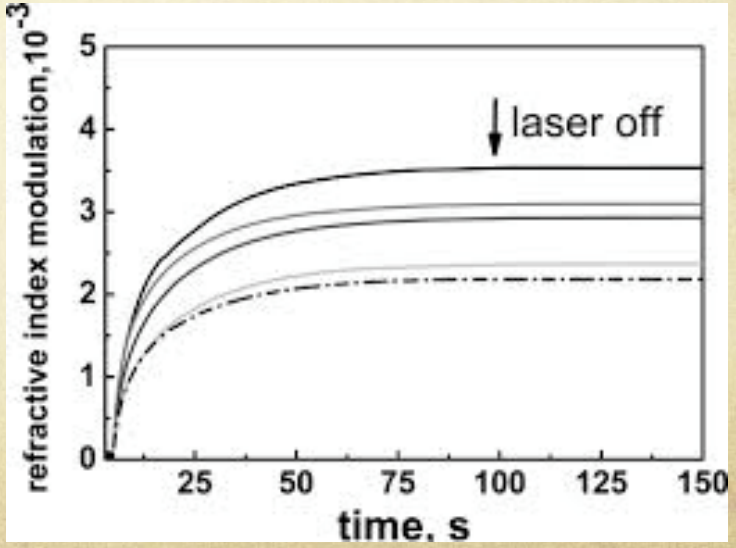
Ink molecules:
donor
Nano marker:
acceptor
Control parameters:
average distance, wavelenghts, ...

Unique fingerprint for novel taggants

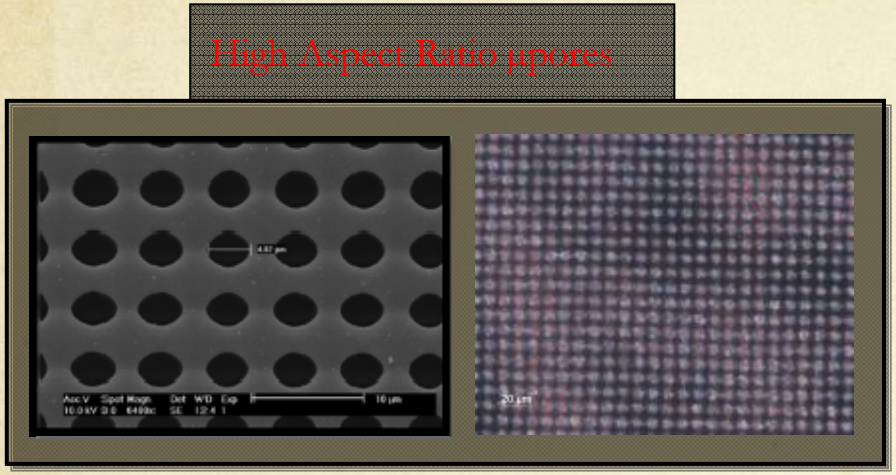
- Photonic meta-materials from soft matter
- Functionalized metal nanoparticles
- Engineered bio sensors
- Surface nano modification
- Nano composites
- Smart lighting materials, …



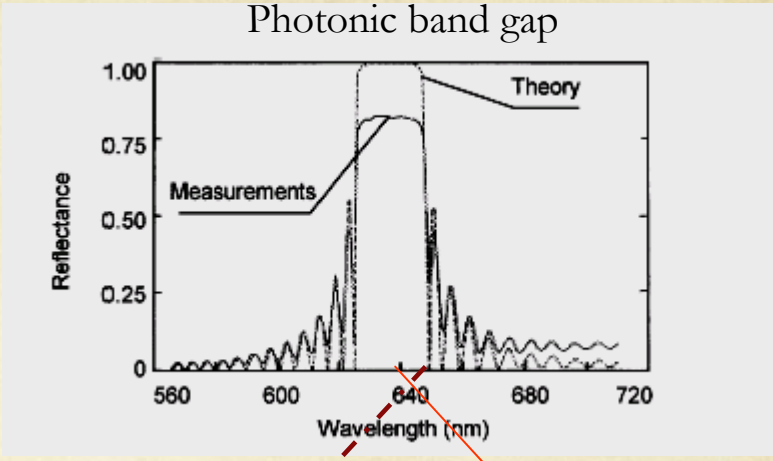




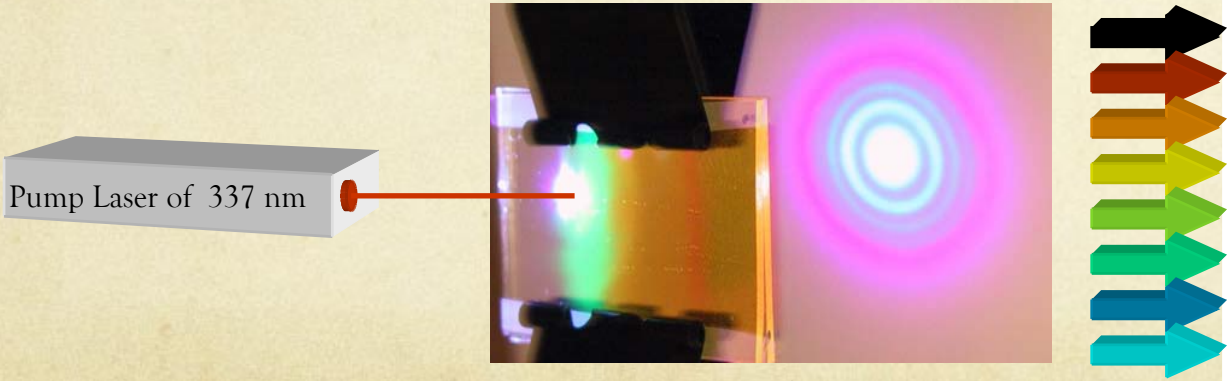
Advanced materials for advanced covert holography



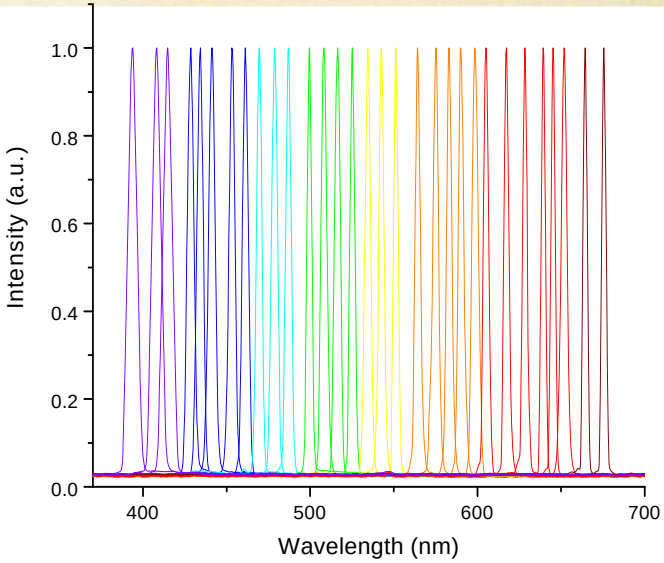
μpores structure that can be infiltrated for instance with nematics and dye doped chiral liquid crystals



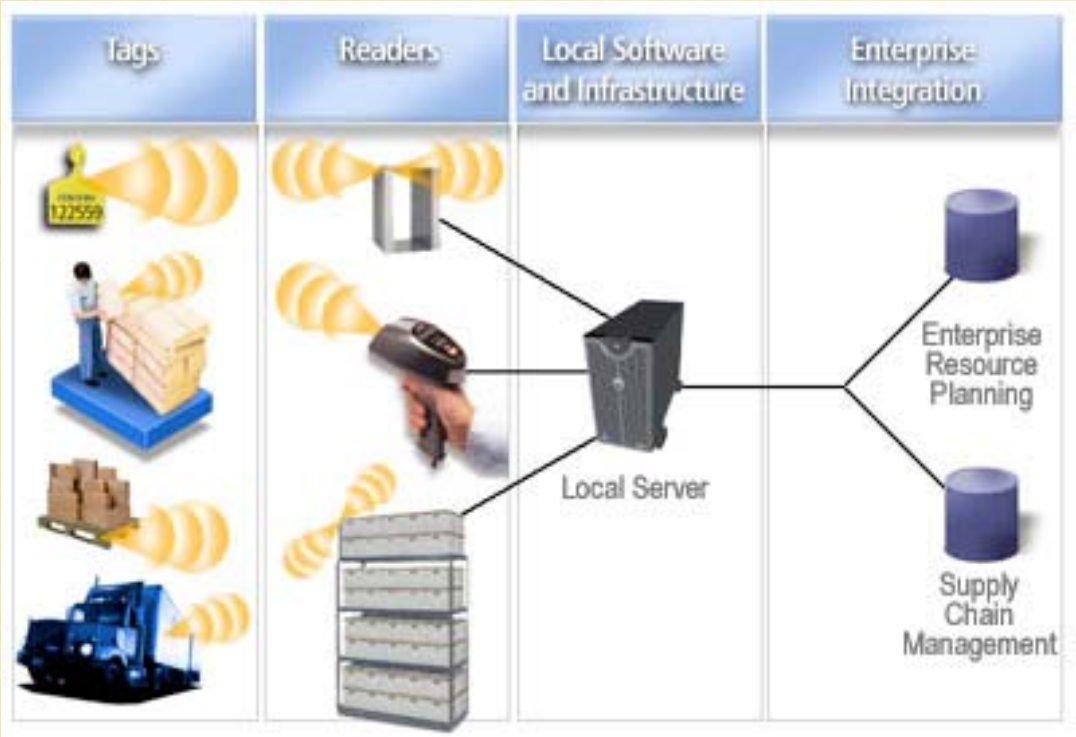
$$\Delta\lambda = \Delta n \cdot p \qquad \lambda = p\frac{n_e + n_o}{2}$$



Modulable and/or self tuning μlasers



A broad panorama of novel solutions



Today tracing, authentication and identification technologies require strong improvements and the best opportunities can be found on novel smart solutions from soft and bio materials at the nanoscale

Working for the future ...