



Nanocomposite Barrier Coatings

Harris A. Goldberg

InMat® Inc.

216 Route 206 Suite 7

Hillsborough, NJ 08844

Phone: 908-874-7788 & Fax: 908-874-7672

Email: hagoldberg@inmat.com

Presented at Nano for Business Meeting May 22, 2008

InMat Inc.



- Develops and commercializes environmentally friendly nanocomposite barrier coatings that reduce permeation of gases, vapors, and chemicals through plastic and rubber products.
- Achieved unique level of barrier performance based on its proprietary platform.
- Commercialized first elastomeric nanocomposite barrier coating (Air D-Fense™ 2000) in Wilson's Double Core tennis ball in 2001

Nanolok™ Products

Elastomeric barrier coatings for:

Sports balls

Chemical protection

Tires

Specialty industrial



Non-elastomeric barrier coatings for:

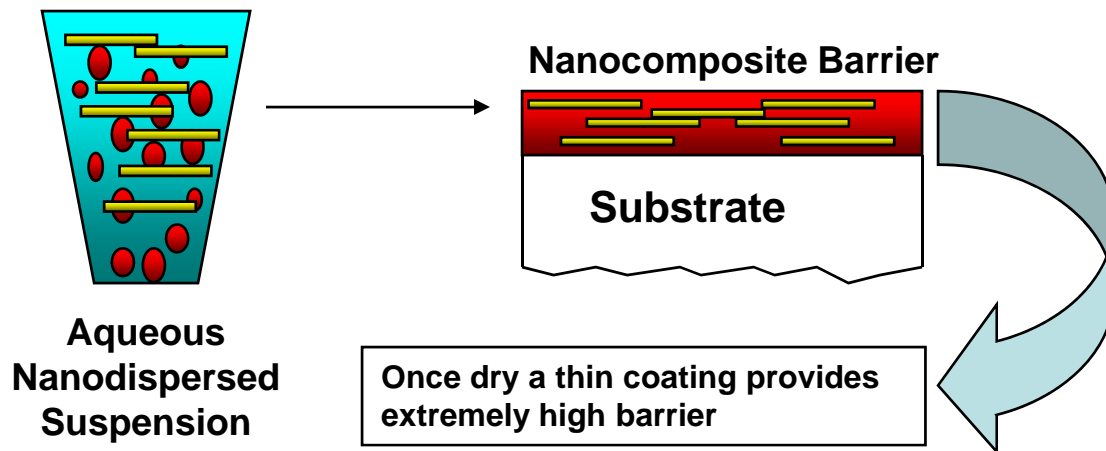
Flexible packaging

Rigid packaging

Medical devices

InMat's Nanocomposite Barrier Coating Platform:

Coating formulations using nanoclay and polymer dispersed in water

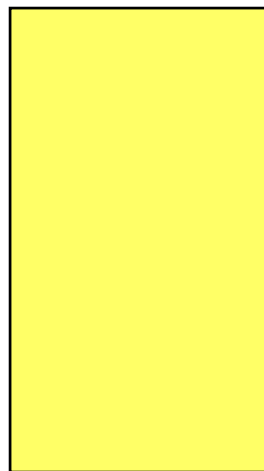


- Reduced Material Costs
- Environmentally Friendly
- Polymer can be chosen to meet the requirements of the market
- Large (2-5 orders of magnitude) improvements in barrier properties over unfilled polymer
- Fundamentally different approach to clay-polymer nanocomposites

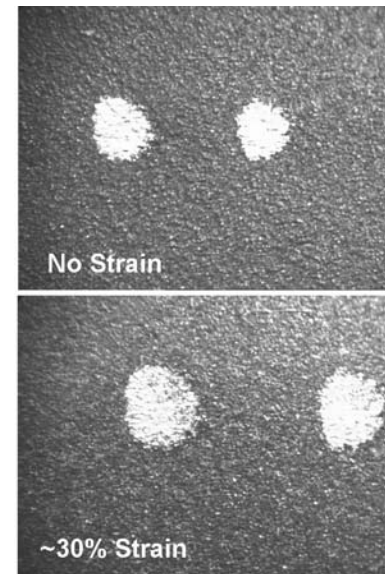
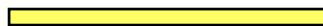
Unique Features of InMat Elastomeric Nanocomposites

- Good barrier maintained and no brittle fracture at large strains
- Compatible with standard rubber processing conditions
- Can be applied using spray or dip coating
- Water based without hazardous materials

1 mm Butyl Sheet



0.01-0.04 mm InMat coating

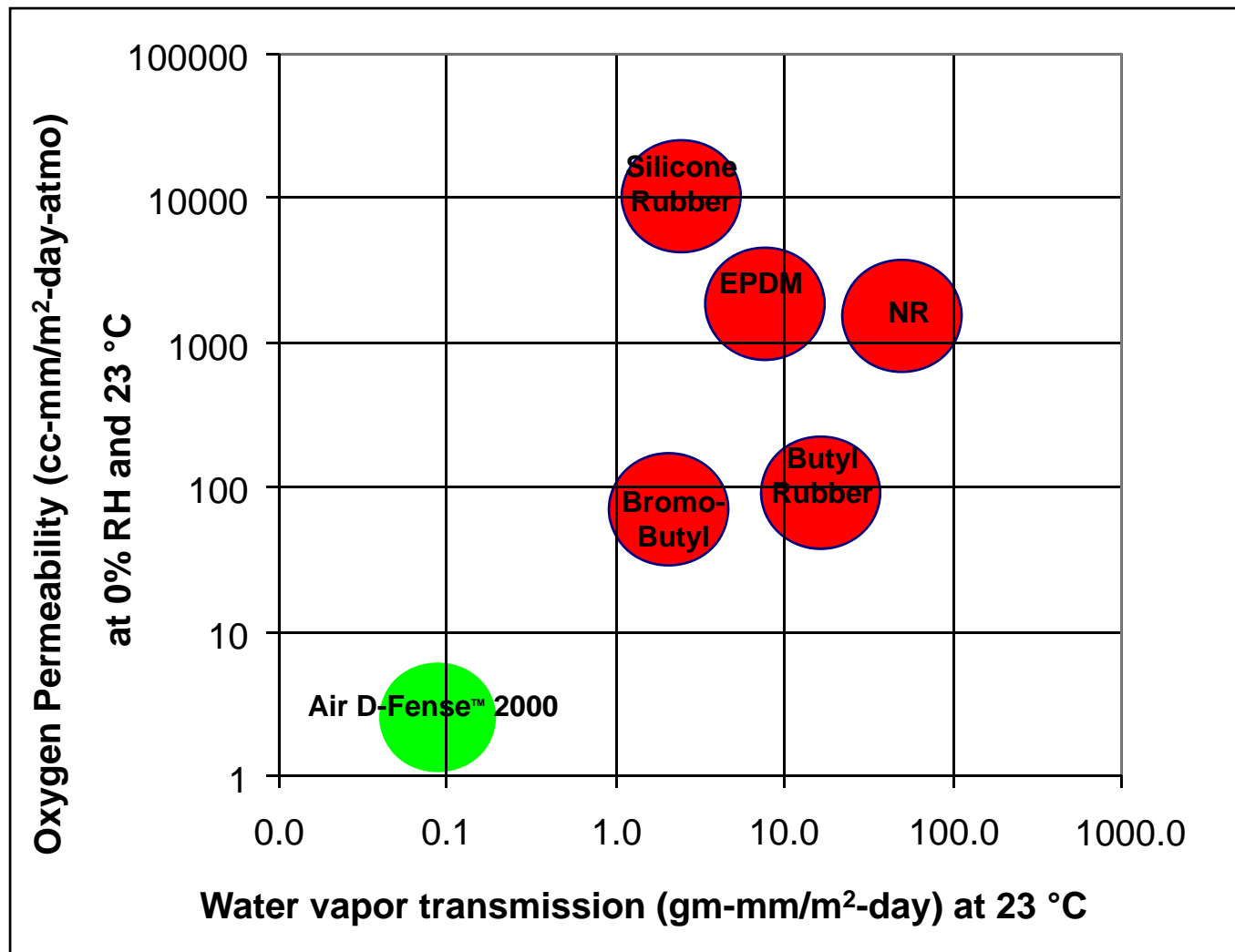


InMat Nanocomposites provide the barrier of thick sheets of rubber in a thin coating.

- Tires – Environmental impact of removing innerliner:
 - 5% weight savings (billion lb reduction in waste)
 - 1-2% reduction in fuel usage

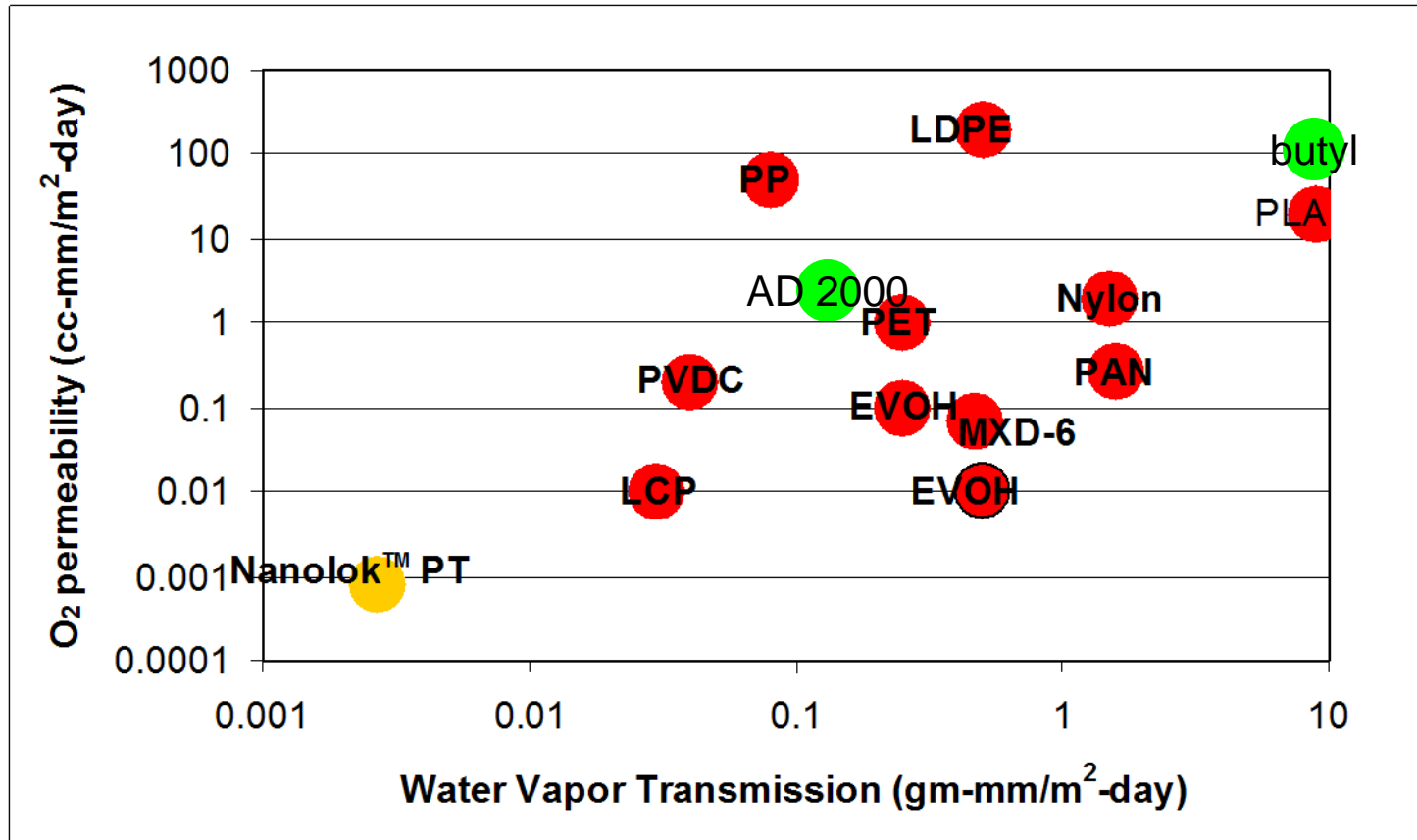
Elastomeric nanocomposite coatings provide a unique combination of flexibility and barrier properties

Relative Oxygen Barrier Effectiveness
 ↓
 Least
 Most



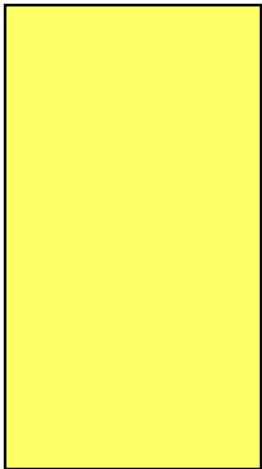
InMat's Nanolok™ nanocomposite barrier coating provide high barrier in a water based environmentally friendly coating formulation.

Relative Oxygen Barrier Effectiveness
 ↓
 Least
 Most

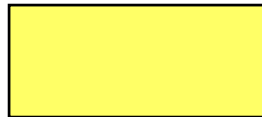


In packaging applications, a very thin coating can be used to provide the required oxygen barrier.

1 mm PET



0.010-0.030 mm
of EVOH



=

0.001mm (1 micron) InMat
coating



Unique Features of InMat Non-Elastomeric Nanocomposites

- Little expected impact on recycle, incineration, or compostability.
 - <~1 micron can replace thicker layers (>10 microns) of EVOH or PVDC
- Can be applied using standard roll coating methods (Gravure, Mayer rod, etc.).
- Water based without hazardous materials
- No VOC's

Applications

Flex packaging:

- Snack foods
- Meat and cheese packaging

Rigid packaging

Thin coatings provide large reductions in oxygen transmission rate

Oxygen barrier independent of substrate

Substrate	Substrate Thickness (microns)	Substrate OTR (cc/m ² -day-atm)	Coated Substrate OTR (1 micron polyester nanocomposite coating)*
PET	12	120	0.8-2.0
BOPP	22	3000	1.0-2.0
PLA	20	1000	1.0-1.5**

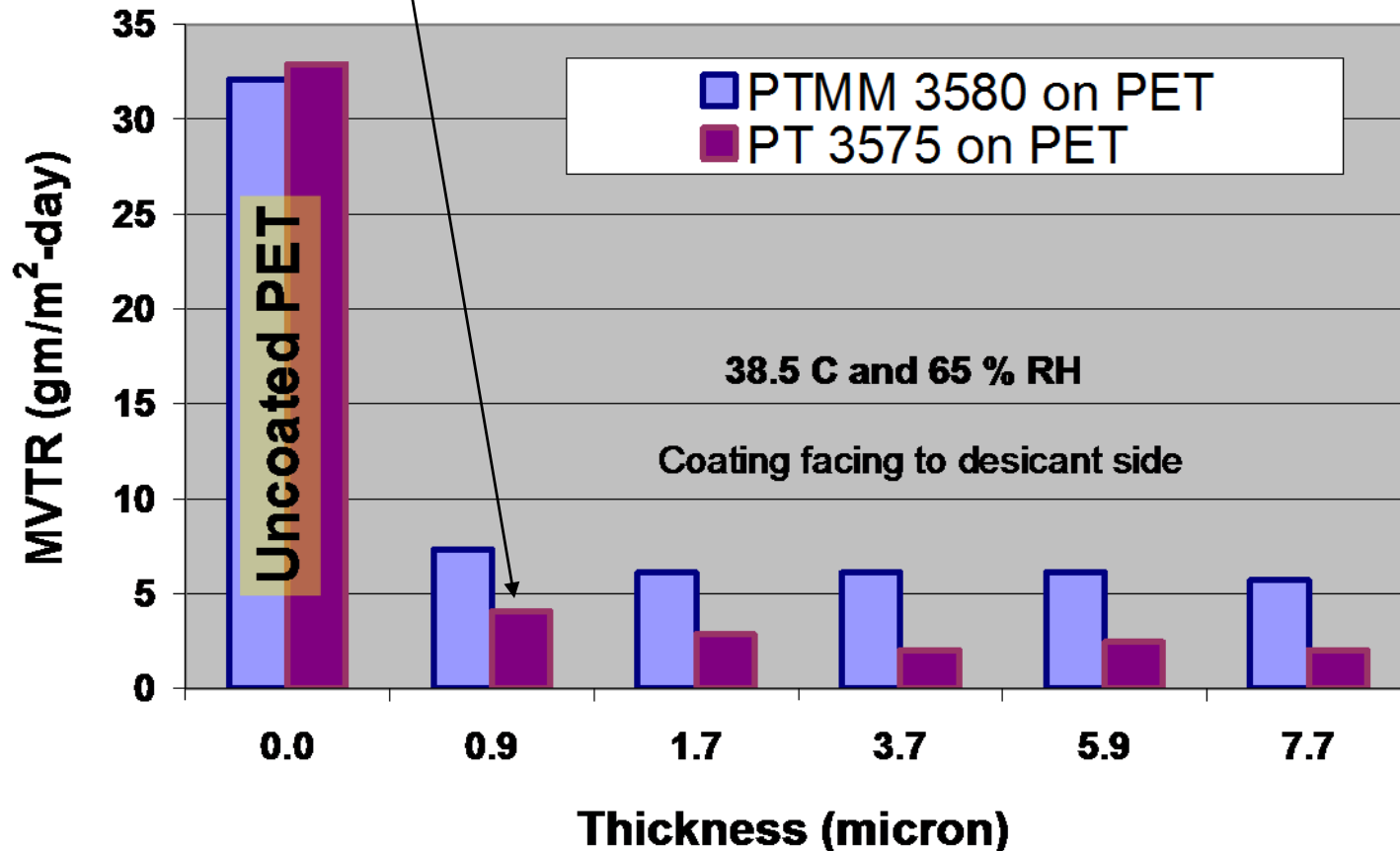
**The range of OTR is due to variations in substrate surface and coating uniformity due to non-optimized coating process.*

*** PLA data only from laboratory samples*

Significant reductions in MVTR can be achieved using InMat barrier coatings

~1 micron coating reduces MVTR of PET to near BOPP levels

MVTR of Nanolok on PET



Summary and Conclusions

- A fundamentally different approach to achieving high barrier products
 - Thin coatings with low cost application technology
- Elastomeric nanocomposites:
 - Unique combination of barrier and flexibility could lead to significant reductions in rubber in landfill and gasoline usage
- Non-elastomeric nanocomposites:
 - cost effective
 - environmentally friendly
 - transparent
 - high oxygen barrier using less polymer and more compatible with current recycle stream.
- Enables significant source reduction by providing high barrier with thin coatings
- Potential for additional significant improvements demonstrated.
- We seek additional development partners who can help accelerate commercialization.