NON-NANO TTIs

Vs

NANO-TTIs

FUNDAMENTALLY & VASTLY DIFFERENT

BASIC DIFFERENCE BETWEEN NON-NANO, COMMERCIALLY AVAILABLE TTI DEVICES

AND

TTI DEVICES BASED ON THE DESTRUCTION OF NANO FILMS

EXAMPLES OF SOME OF THE GRADUALLY COLOR CHANGING COMMERCIALLY AVAILABLE TTI DEVICES

Figure 4-3. Color response of the Lifelines Fresh-Check TTI from activation to endpoint.

Figure 4-2. Color response of the Vitsab C2-10 TTI from activation to endpoint.

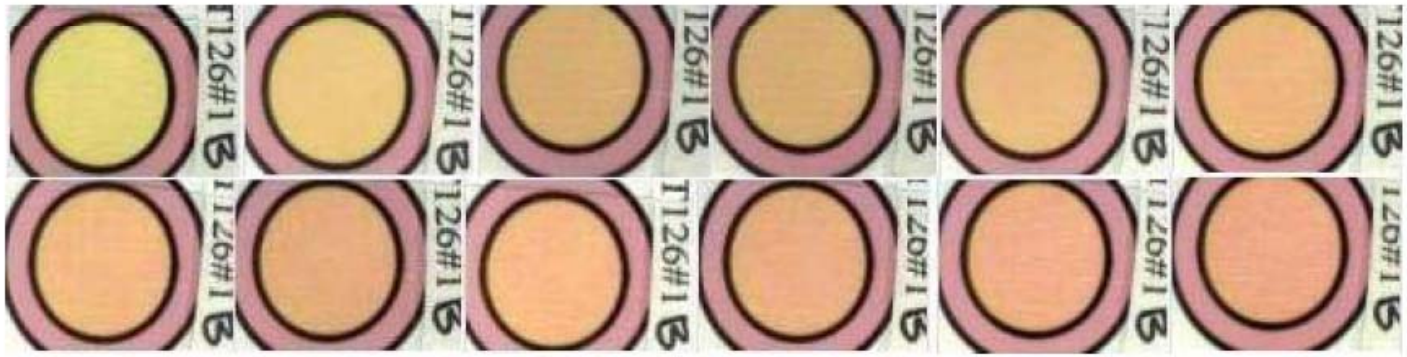
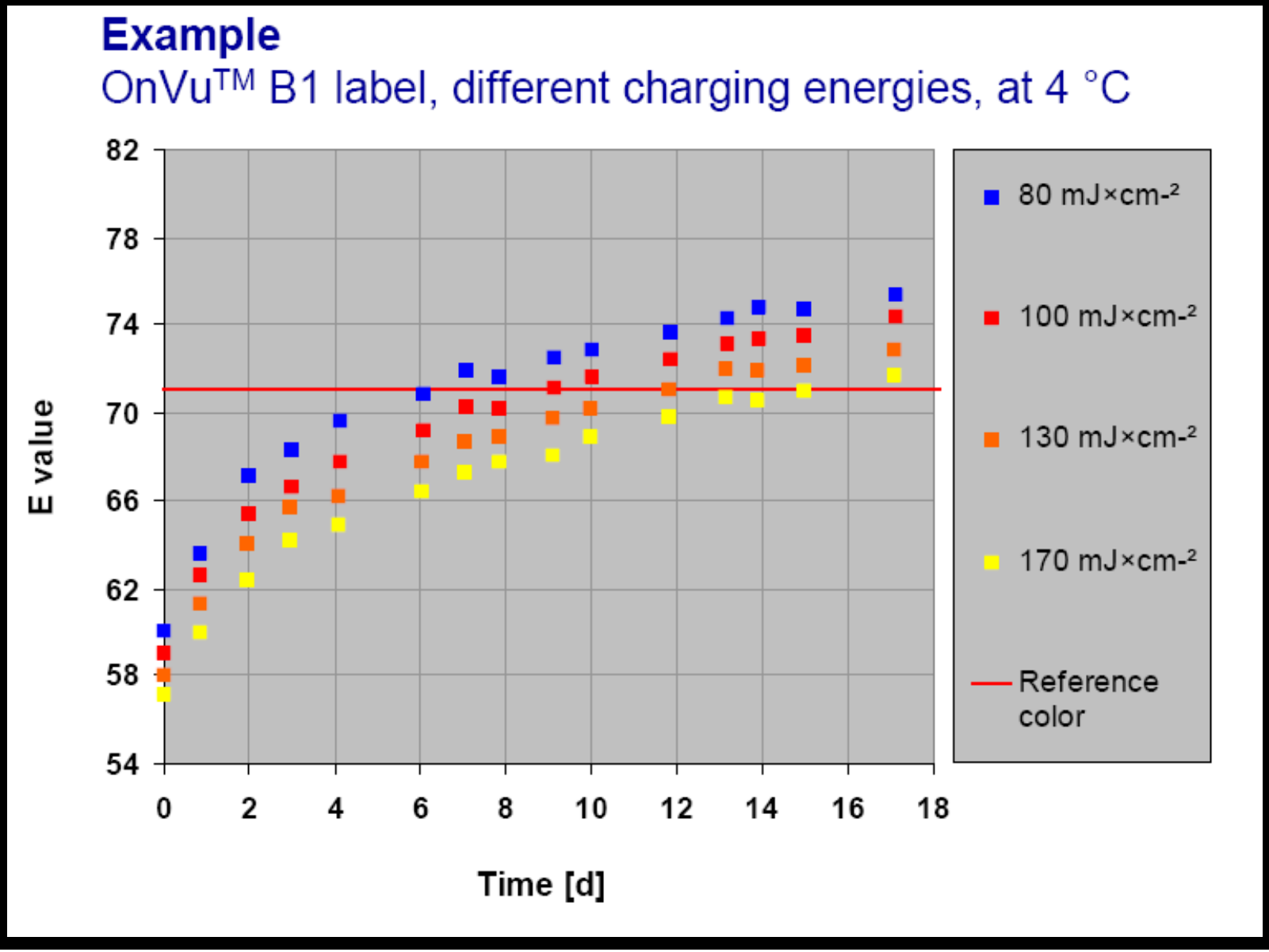


Figure 4-7. Color response of the Avery Denison T126(1) at 5°C over 12 days.

EXAMPLE OF KINETICS OF A COMMERCIAL TTI



Click on image below for video

PERFORMANCE OF NANO-TTI Vs NON NANO-TTI DEVICES

Nano-TTI Vs Non Nano-TTI

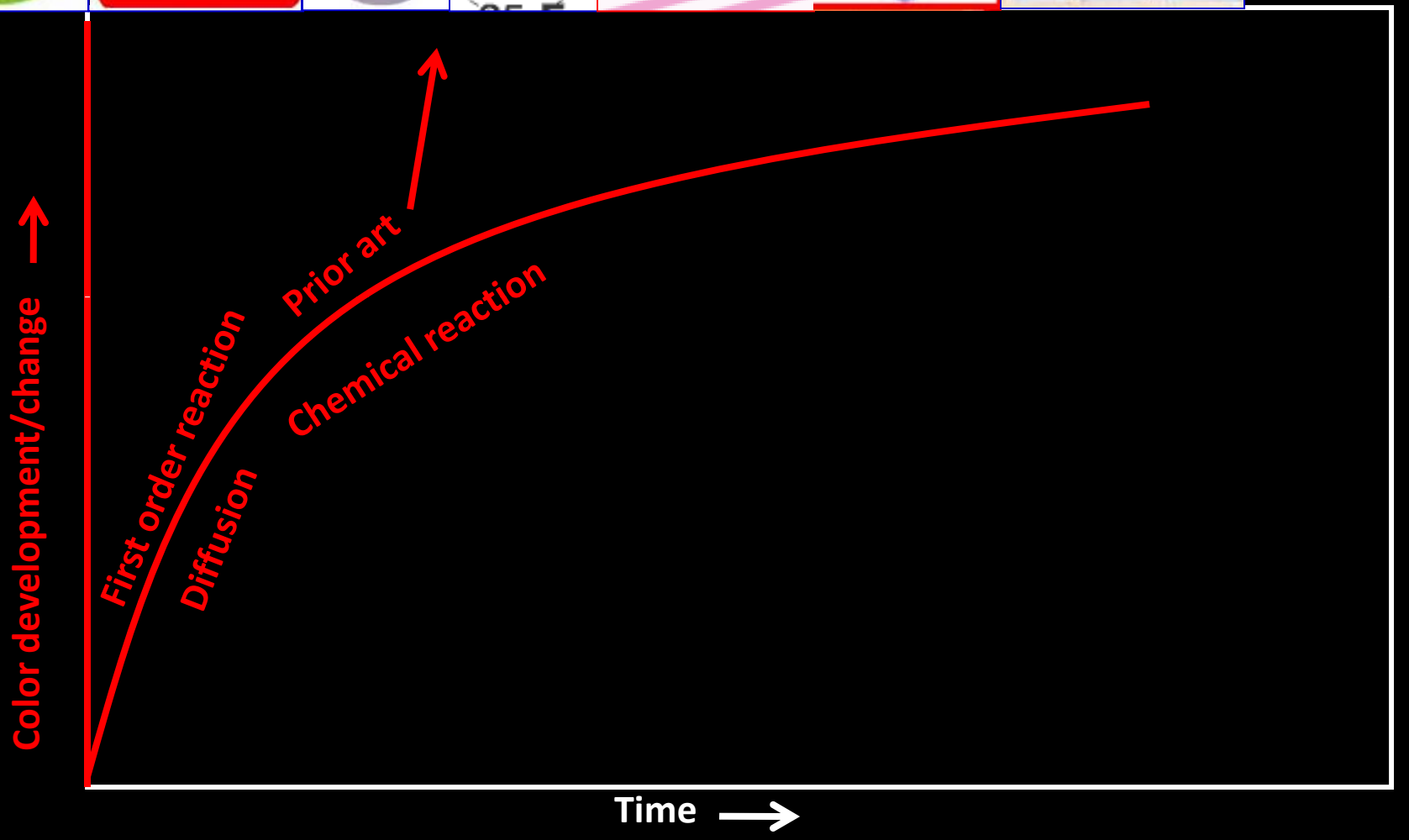
(Note abrupt color change)

(note gradual color change)

Click on image below for video

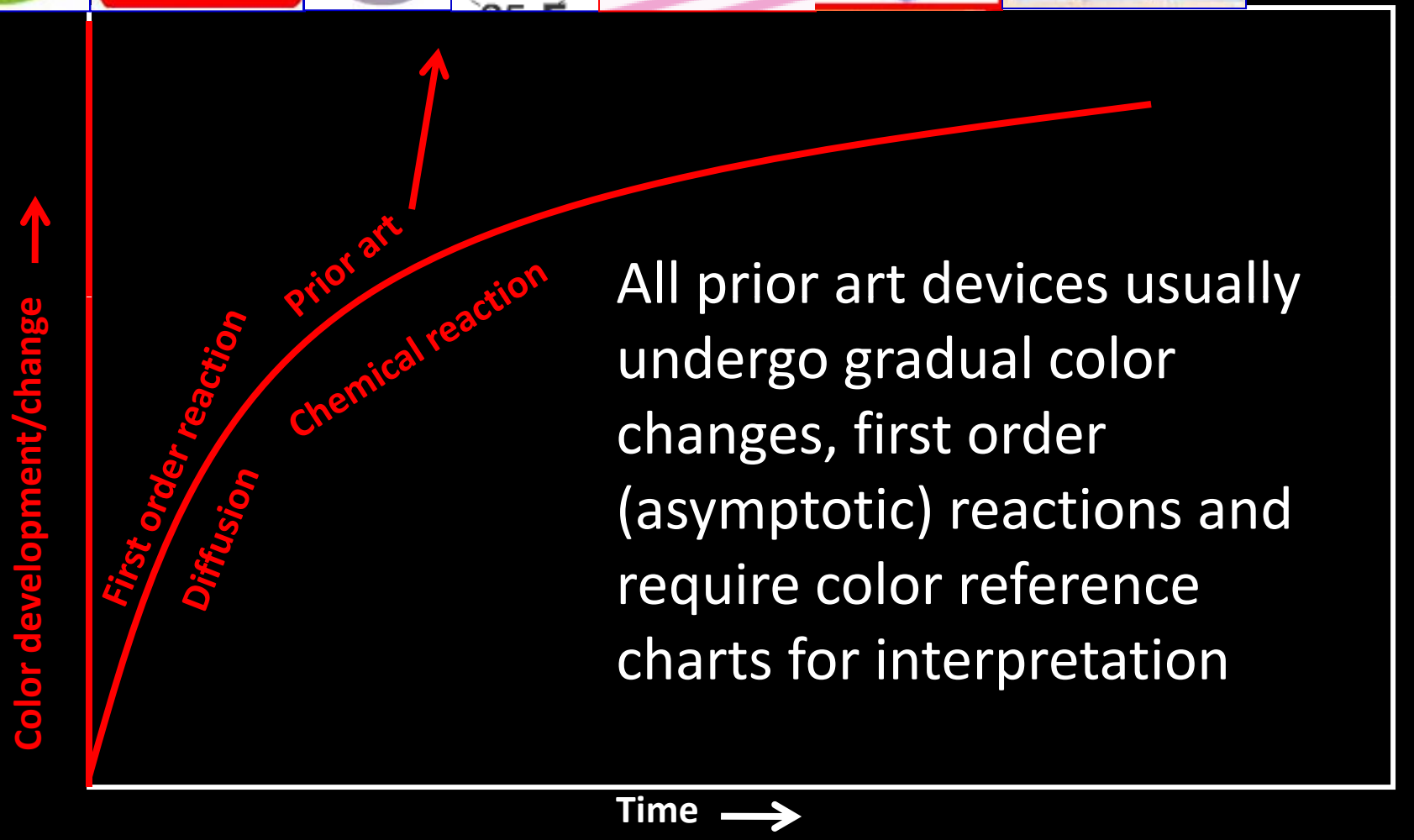
← Time

THE BASIC DIFFERENCES – Prior art



A schematic presentation of color development versus time of prior art devices

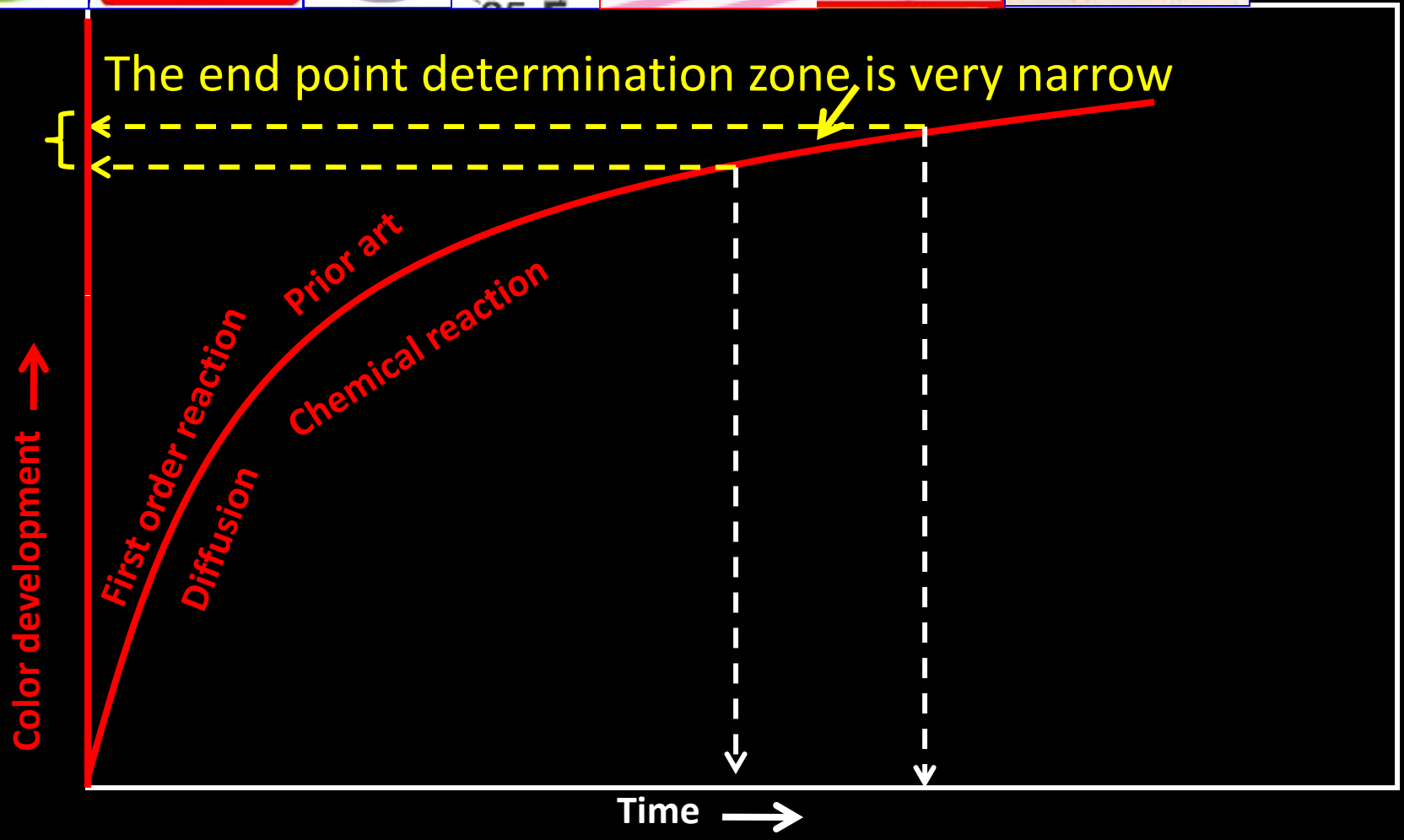
THE BASIC DIFFERENCES – Prior art



All prior art devices usually undergo gradual color changes, first order (asymptotic) reactions and require color reference charts for interpretation

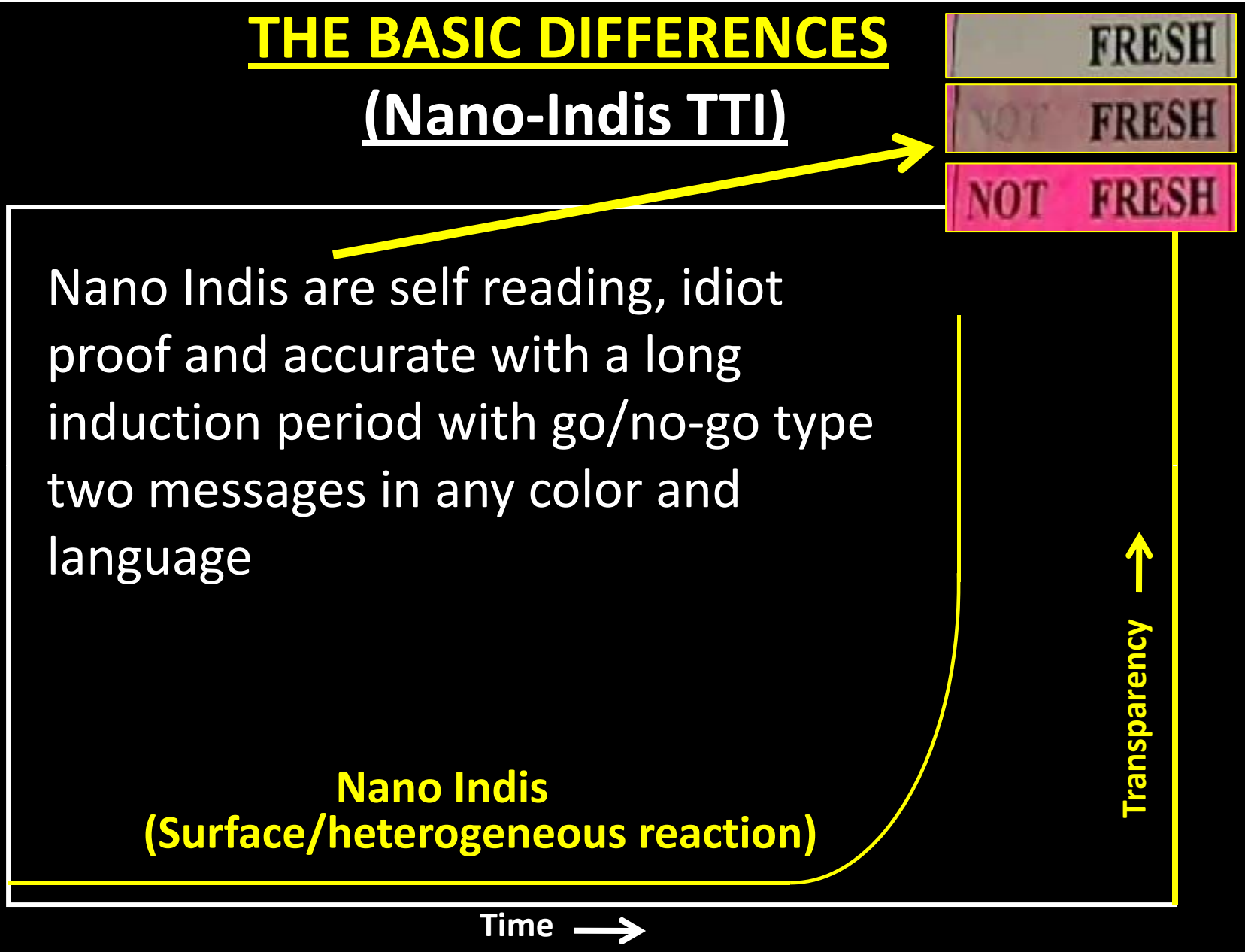
A schematic presentation of color development versus time of prior art devices

THE BASIC DIFFERENCES – Prior art



A schematic presentation of color development versus time of prior art devices

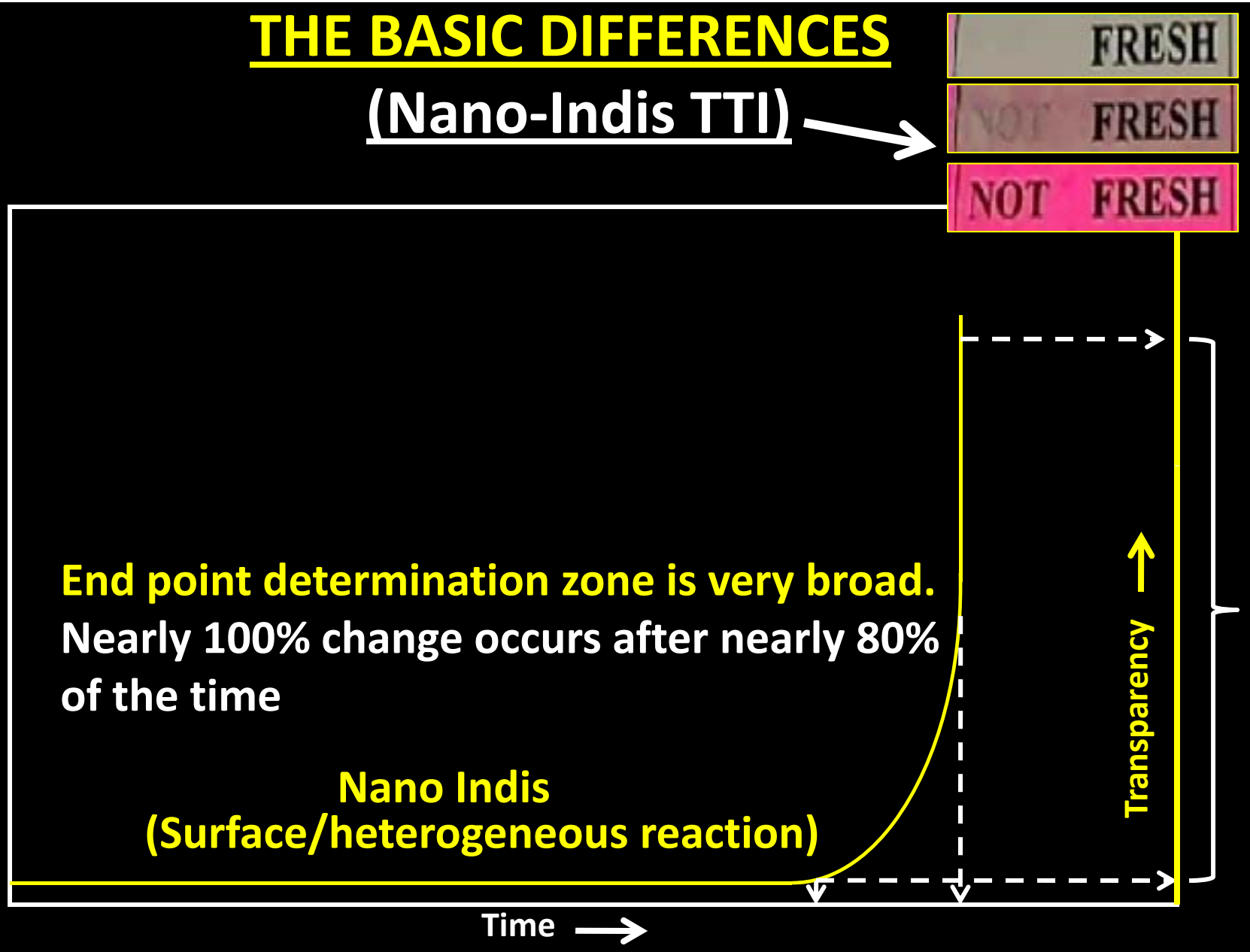
THE BASIC DIFFERENCES
(Nano-Indis TTI)



A schematic presentation of change in transparency versus time of current nano devices

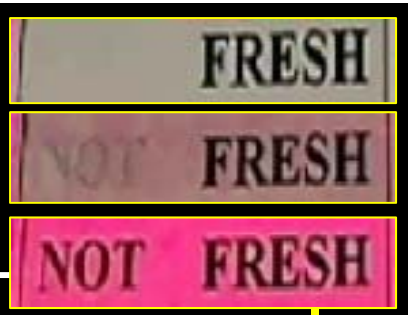
THE BASIC DIFFERENCES

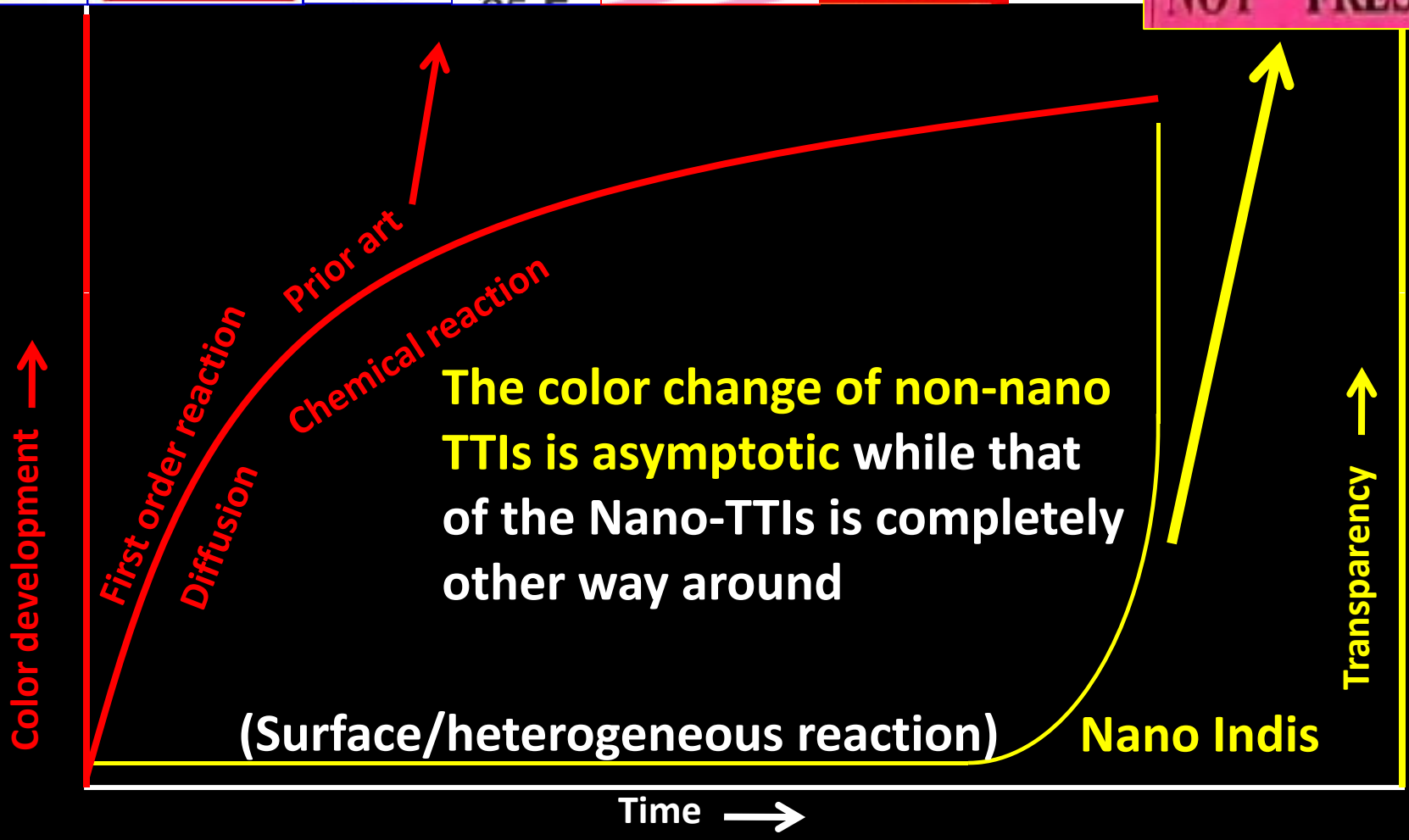
(Nano-Indis TTI)



A schematic presentation of change in transparency versus time of current nano devices

THE BASIC DIFFERENCES





A schematic presentation of color development (transparency) versus time after the activation of a prior art and current devices

NANO-INDI TTI

(Labels/stickers)

- No color reference chart required
- Not subjected to interpretation
- Self-reading (idiot proof)
- No need for training or explanation
- 100% irreversible
- Unlimited colors and messages
- Machine readable
- Long induction period (go → no-go type)
- Reaction linear with time
- Expiration time can be varied from minutes to years
- Activation energy can be varied from 7 to 40 Kcal/mole
- Simple to make and inexpensive
- Unactivated can be stored for years
- Easy to activate
- Can be activated on line
- Small & thin (~inch^2 & ~4 mil)

NANO-INDI MOVING BOUNDARY TTI

Additional features

- Small & slim (~1”x0.5”X4 mil) & flexible
- Boundary moves linear with time
- No liquid used (i.e., solid state)
- Full movement of the boundary can be varied from hours to years
- Accurate (~±5%)
- Activation energy can be varied from 7 to 40 Kcal/mole
- Unactivated device can be stored for years
- Easy to make & inexpensive
- Easy to activate & can be activated on line
- No toxic chemicals used

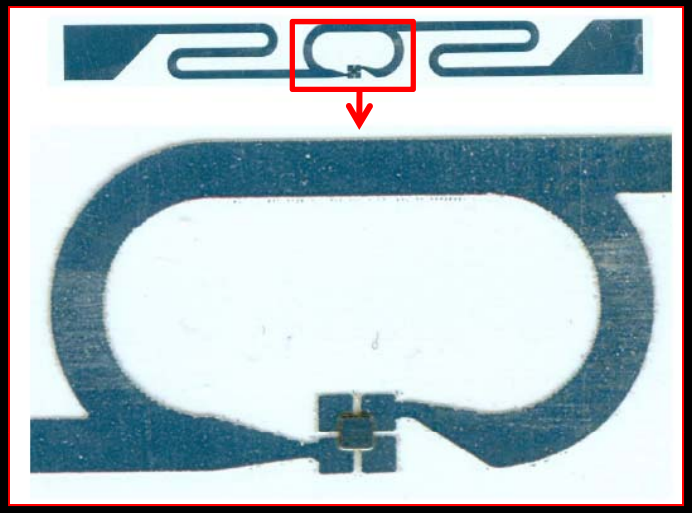
NANO-INDI SEALING TAPE TTI

(1) Activated

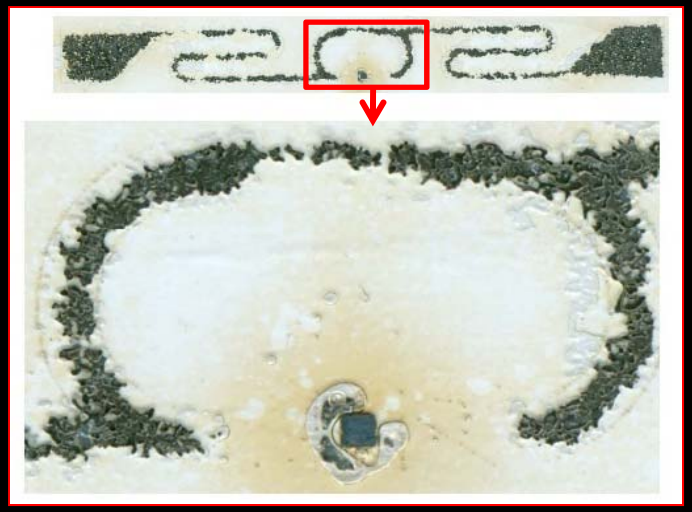
(2) 25 hrs/expired

- A new class of TTI
- Has all other properties of sticker and moving boundary TTIs
- Only slightly more expensive than a normal packaging tape
- The sealing tape TTI could provide a message, image, barcode and a color change
- Can be in form of moving boundary
- It seals a box and also monitors shelf life
- It is highly likely that many perishable manufacturers/distributors will use this type of sealing tape TTIs as they don't require any special equipment, operation, any special training and very little increase in cost

NANO-INDI RFID TTIs



(a) Activated & readable



(b) Expired and non-readable

- RFID-indicators, such as RFID-TTIs and others are highly desired but not reported
- We have developed nano-RFID inlays and processes for monitoring time, time-temperature and other processes
- When activated with an activator tape, the antenna of a RFID inlay gets destroyed and makes the RFID non-readable
- Inactivation can be monitored remotely and can be visually seen
- **Nano-RFID TTIs makes it possible to monitor quality and inventory of perishables during distribution**

NANO INDIs ARE FUNDAMENTALLY DIFFERENT FROM THE PRIOR ART AND HAVE ALMOST ALL DESIRED PROPERTIES

NANO-INDIS™

A REVOLUTION IN INDICATOR TECHNOLOGY

FUNDAMENTALLY & FUNCTIONALLY VASTLY DIFFERENT

NANO-CONVERSION TECHNOLOGY

AN IGNORED BUT NOVEL AND UNIQUE FIELD OF NANOSCIENCE

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