ARKEMA

Kynar® ADX

Polyvinylidene Fluoride

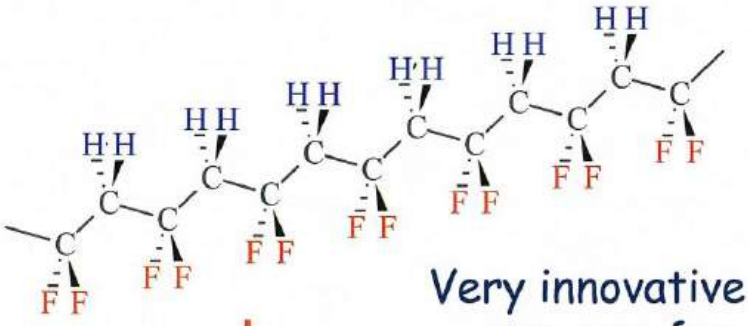
for Powder Coating

INTRODUCING KYNAR® ADX

- Kynar® ADX is functionalized Kynar® PVDF
- The key feature of Kynar® ADX is its reactivity …
  … providing direct adhesion to metals : steel, aluminium, copper
- All/most other properties are similar or close to those of regular Kynar® PVDF:
  - Chemical resistance
  - Barrier properties
  - Thermal resistance
  - Mechanical resistance
  - Processability / stability
  - Miscibility with acrylics
  - Miscibility with Kynar® PVDF solvents

PREPARATION OF KYNAR® ADX (I)

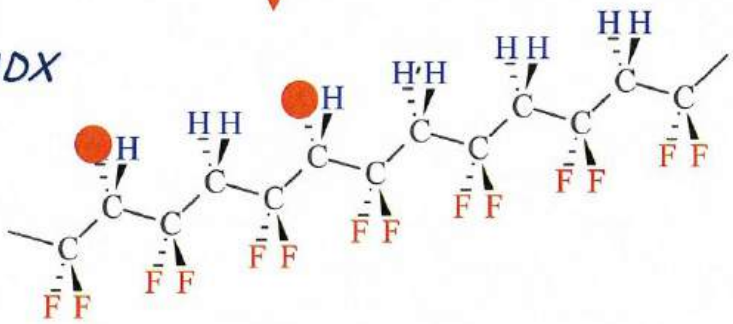
• KYNAR®



Very innovative (patented) process for grafting

● reactive group

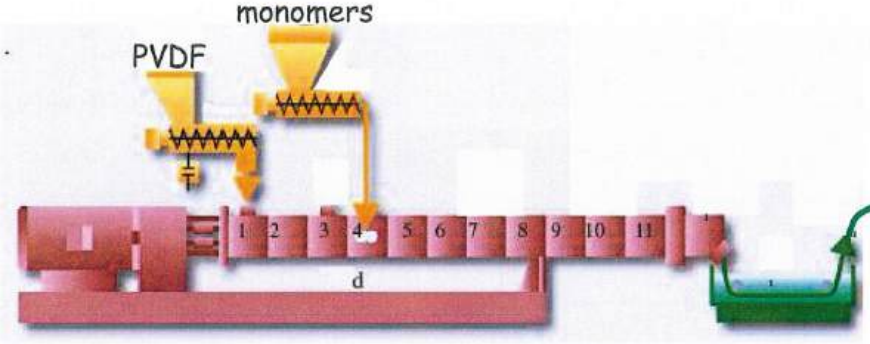
• KYNAR® ADX



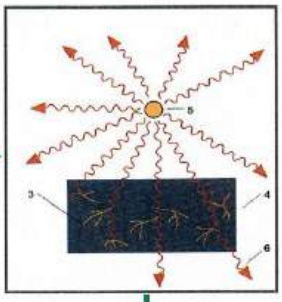
PREPARATION OF KYNAR® ADX (II)

Unsaturated monomers

PVDF



hν: **Radiation** at very low dose and room temperature



Screw profile
Temperature profile
Output

Finishing section

KYNAR® ADX

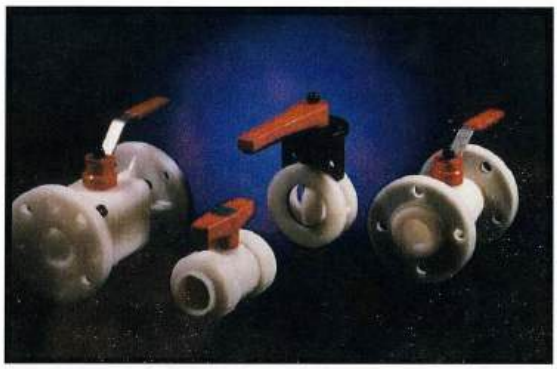
KYNAR® ADX for POWDER COATING

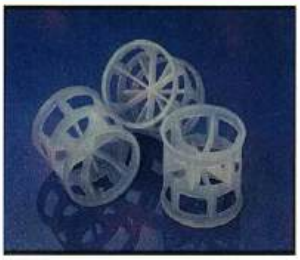
- Allows primerless powder coating (direct adhesion to metals) after standard surface preparation
- Can be used easily in the standard application processes:
  - Dip coating in fluidized bed
  - Electrostatic spraying
  - Hot spraying
- Product range:
  - Kynar® ADX 111 : PVDF homopolymer
  - Other grades under development :
    - PVDF copolymer
    - pigmented version (green) of homo and copo ⇨ aspect, easy identification/differenciation

Melt. Point (°C)	Flex. Modulus at 23°C (Mpa)	Characteristics
167	2200	thermal stability stiffness
156	1000	flexibility

- Strong experience of Kynar® PVDF in CPI applications
  - Similar chemical resistance as regular Kynar® PVDF
  - Durable adhesion ensured by thickness enough and low permeation of fluids in contact

SOME CPI EXAMPLES

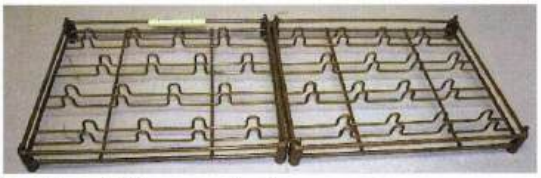




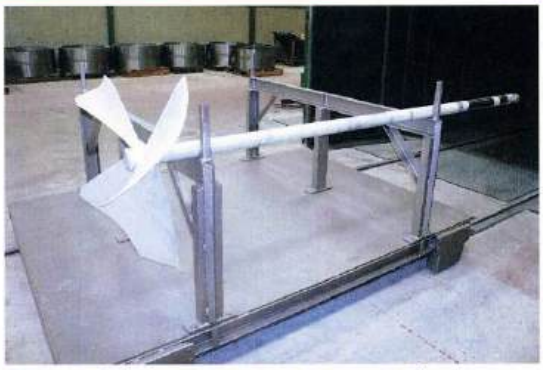
A STRONG EXPERIENCE IN "CPI"

with regular Kynar® PVDF

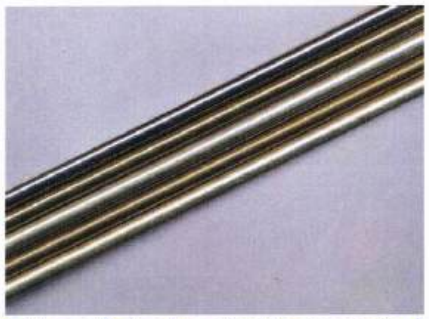
EXAMPLES OF COATED PARTS



Basket (dip coating)



Mixer (electrostatic spraying)



Tubes (electrostatic spraying)

Cylinder inside (hot flocking)

Part (dip coating)

PHYSICAL PROPERTIES

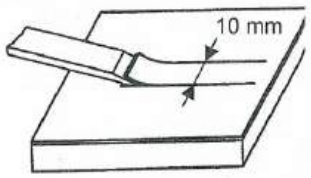
	Units	Homopolymer Kynar ADX 111 (natural or green)	Copolymer Kynar ADX 281 (natural or green)
PHYSICAL PROPERTIES			
Specific density *	g/cm3	1,78	1,77
Water absorption to saturation, 23℃/50%RH	%	0,15	0,15
THERMAL PROPERTIES			
Melting temperature, +20℃/min	℃	167	156
Crystallization temperature, -20℃/min	℃	135	130
Thermal Decomposition Temperature (1%wt loss in air, at +10℃/min)	℃	370	370
MECHANICAL PROPERTIES			
Flexural Modulus at 23℃ *	Mpa	2200	1000
Hardness *	Shore D	80	70
Abrasion, Taber CS-17 1000g:pad *	mg/1000cycles	6-9	5-9
Notched IZOD impact strength at 23℃ *	J/m	80	210
FIRE PROPERTIES			
LOI *	%	43	43
Burning rate UL94 *	classification	V-0	V-0

(*) from corresponding regular (non-grafted) Kynar PVDF grades

ADHESION (I)

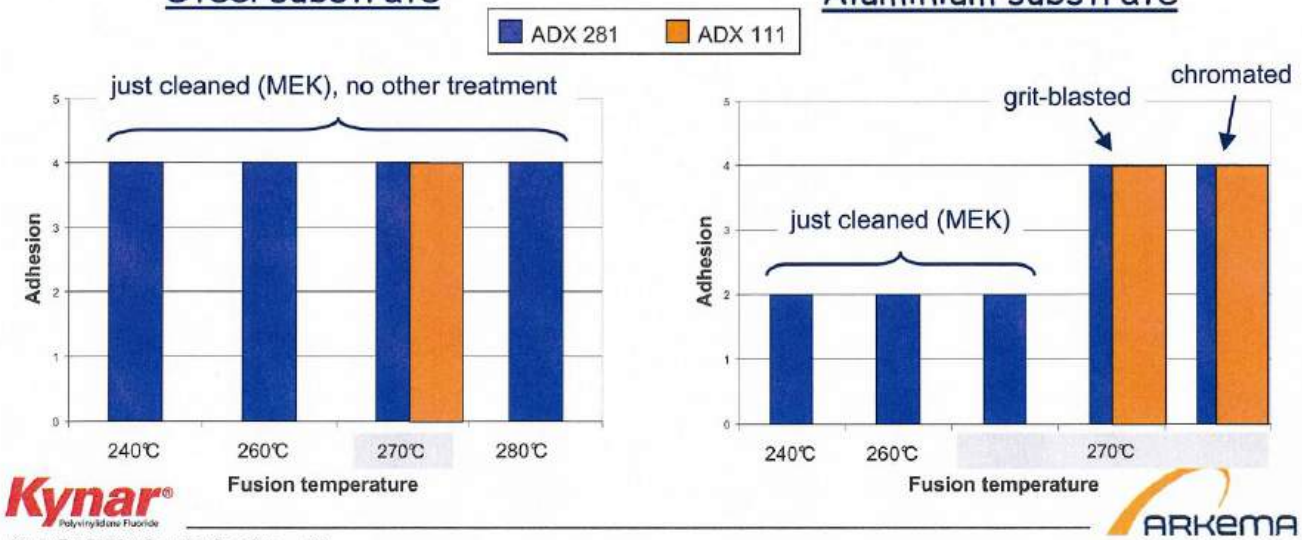
- Adhesion test (standard NFT 58-112)
  - Make two parallel cuts to define the stripe to be peeled of
  - Force the knife under the coating
  - Express adhesion level using the following scale:

4	no decohesion observed
3	non-uniform decohesion accounting for less than 50% of the surface
2	decohesion with limited efforts, some strong links regularly spaced
1	decohesion with limited efforts
0	easy decohesion



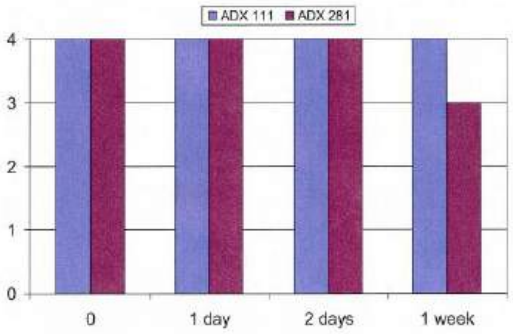
ADHESION (II)

- Excellent primerless adhesion is achievable by the various application processes
- Example of Electrostatic Spraying
  - on 3mm thick plaques, fusion 10min, with *Kynar® ADX281 and ADX111 natural*



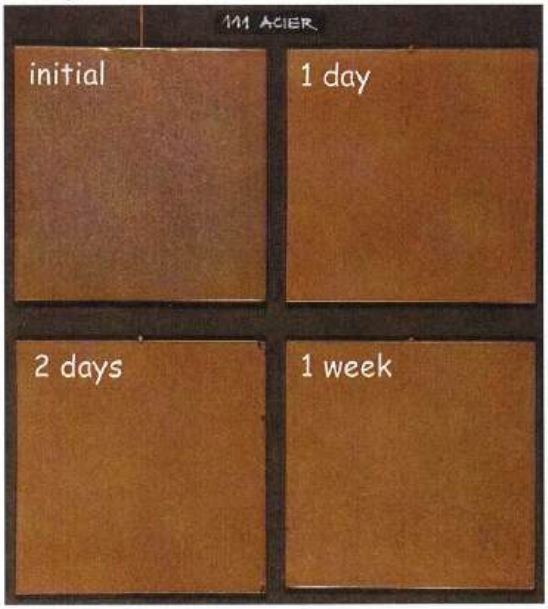
DURABILITY OF THE ADHESION (I)

- In <u>boiling water</u> (coating ~100µm, ES, steel)



<u>Steel substrate</u>

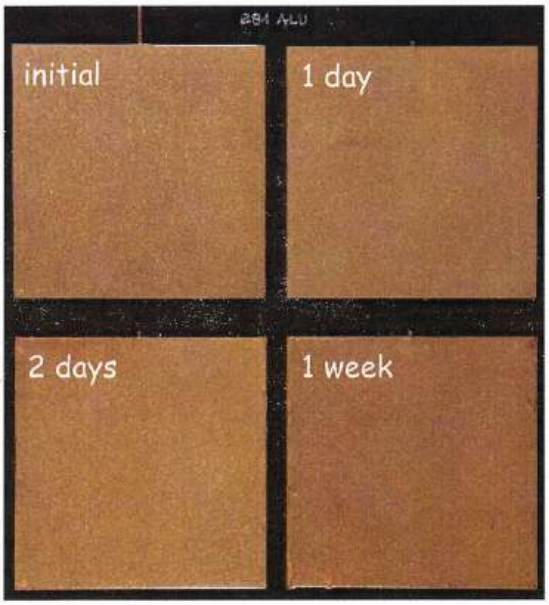
grit-blasted



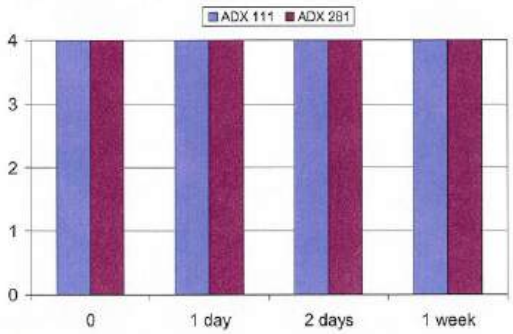
⇨ excellent adhesion retained up to 1 week immersion

DURABILITY OF THE ADHESION (II)

- In <u>boiling water</u> (coating ~100µm, ES, aluminium)



grit-blasted

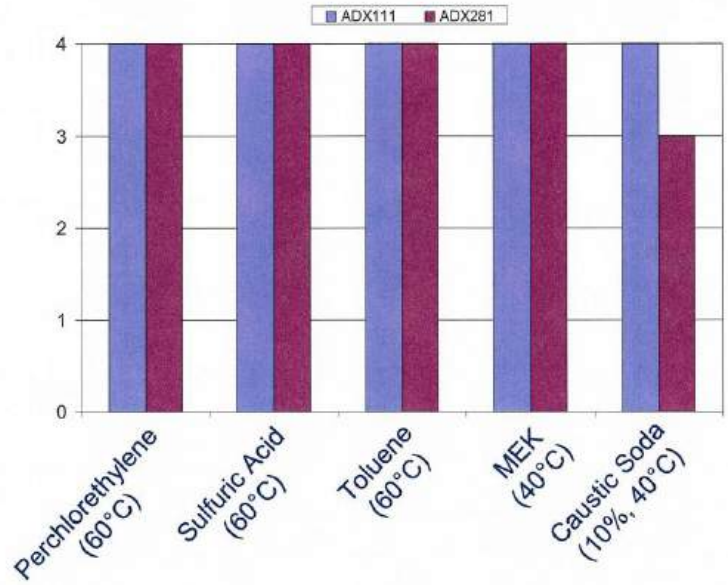


<u>Aluminium substrate</u>

⇨ excellent adhesion retained up to 1 week immersion

DURABILITY OF THE ADHESION (III)

- In <u>various chemical environments</u> (coating ~100µm, ES, steel)
  grit-blasted



⇨ excellent adhesion retained after 2 weeks immersion

ELECTROSTATIC SPRAYING

of Kynar® ADX powders

- Surface preparation
  - Degreasing
  - Pretreatment : grit-blasting (G17 steel grit typical) or chemical etching
  - No primer required
- Powder spraying
  - Negative (-80V to -100V typical) or positive voltage can be used
- Fusion
  - Up to 10-15 min. at 240-270°C depending on thickness and nature of metal
  - In oven with good ventilation (air speed < 3 m/sec.)
- Coating thickness
  - From 80 µm to 120 µm per application
  - Additionnal layers can be applied in similar conditions

DIP COATING

with Kynar® ADX powders

- Surface preparation
  - Degreasing
  - Pretreatment : grit-blasting (G17 steel grit typical) or chemical etching
  - No primer required
- Preheating
  - Preheating time and temperature depend on design and metal thickness and coating thickness target:
    - from 4 to 10 min. at 340-360°C for thin parts
    - up to 30 min. at 300-340°C for massive parts
- Dipping in a fluidized bed
  - Operate in well ventilated area, with air exhaust near the top of the tank
  - Surface temperature of the hot part should not exceed 350°C for contact with Kynar® ADX
  - Hot part dipped into fluidized powder, from 2 to 6 sec. typically
- Coating thickness
  - From 200 µm to 500 µm (or even higher for massive parts)

BUILDING THICKNESS

- Typical thickness achievable by each process
  - Electrostatic spraying : 80-120µm per application
  - Dip coating : 200-500µm typical and up to 1mm
  - Hot flocking : up to 1mm or even higher
- Example of Dip Coating
  - on 3mm thick plaques, preheating 10min/360°C, with *Kynar® ADX 281 green*