SAC – DETECTOR WORKING GROUP: Plastic Scintillators

Jim Freeman
Anna Pla-Dalmau

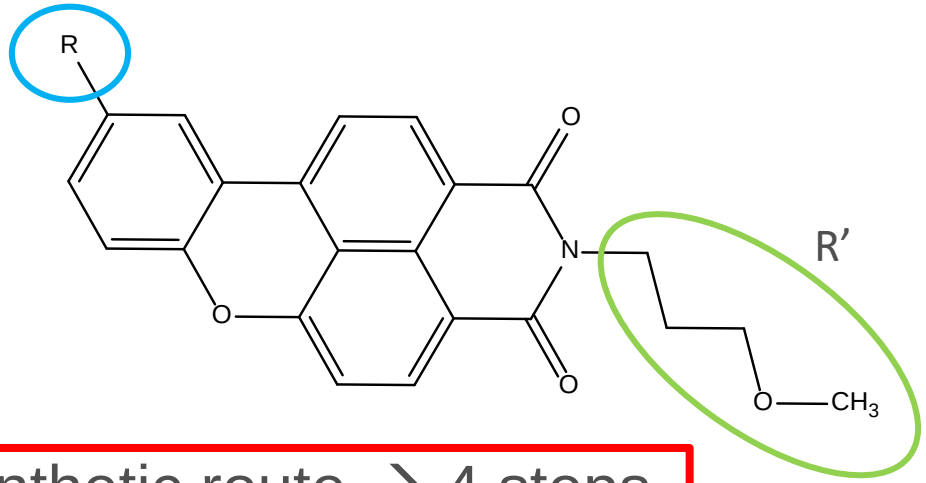
April 19, 2019

DOPANTS – GREEN-EMITTING AND FAST?

With R = Methyl group → K27

Most green WLS fibers use K27:

- Commercial source?
- 12 ns decay time
- Why?
  - Stable! And good LY



- Developed a synthetic route → 4 steps
- Started to make variations:
  - Change R and R'
- Goal – Shorten the decay time without losing light yield

DOPANTS – BARIUM FLUORIDE

- Extruded plastic scintillator with *micron-size* barium fluoride
  - Light yield increase (thin sample, not very clear)
  - Repeat with *nano-sized* barium fluoride
- Ordered toluene solution of barium fluoride nanoparticles
  - Tested in styrene polymerization – FAILED
    - incompatible coating
  - Tested in polystyrene castings – OK, pending LY measurements
  - Not tested in extrusion yet

- Presence of high Z materials → Improve scintillator sensitivity to high energy photons

3D PRINTING SCINTILLATOR MATERIALS

- Tested @ FNAL years ago:
  - Made polystyrene scintillator filament with lab-size extruder
  - Not clear – 20% LY of regular scintillator
- UV-curing acrylates are available
- Explore polysiloxanes:
  - Very clear and radiation hard
  - Commercial products?
  - Scintillation properties?
    - Many do not scintillate

  - Develop the ink formula
  - Develop the scintillator formula