# Radiation Hardness Assurance. Military/Space grade. Contacts with manufacturers.

- Example of Rad. Hardness specifications. Military Grade Chip RH3080. (https://www.analog.com/en/products/rh3080mk.html#product-overview)

  **TID =200 krad** at 50 rad/c;
  **TID =100 krad** at 10 mrad/c ;
  SED SEU SEL = 120 MeV/cm^2/mg;
  **DDD =1.E+12 n/cm^2.**
- More Examples of Rad. Hardness specifications.

Data Device Corporation **TID >=100 krad** (memory and processors),
CMOS chips up to **DDD=1.E+15 n/cm^2** and **50 krad**.
TTL 5400 The low-power Schottky (LS) **TID=1000 krad**.
Emitter-coupled logic (ECL) **TID= 1.E+4 krad**.

- For now E-mails are sent to:

1) ARI Corp (www.aricorp.com), Jozef Lebiedzik. Preamplifier PMT-5R for active collimator. Responded:"...All parts in the PMT-5R are standard commercial grade rating… most sensitive is **CMOS LMC662** …".
2) Rockwell Automation. (https://www.rockwellautomation.com). Allen Bradley 1769-L35E controller. Responded : no grade specifications (we should assume commercial/industrial)-> Next step:
3) Mail to Allen Bradley https://industrialautomationco.com/collections/allen-bradley-electronic-parts. sales@iac.us.com
4) HiCube Pro in relation to Turbo Pumping Station. info@pfeiffer-vacuum.de www.pfeiffer-vacuum.com/en

- Most likely all chips in Tagger Hall are of **commercial grade**. Therefore, for the electronic chip Lifetime estimates we may use:

  **Chip TID = 5-10 krad** — **Teflon TID =>1Mrad**
  **Chip DDD = E+(11:15) n/cm^2** — **Teflon DDD =>E+13 n/cm^2 (14 MeV)**

  **References in Technical Note.**

## Radiation Hardness of plastics. See Technical Note for references.

| **Material** | Neutron /$cm^2$ | TID /rad | TensStr /% | TensStr /psi | Elong /% | Tickness /in | Ref. |
|---|---|---|---|---|---|---|---|
| Teflon(PTFE), air | - | 1.E+5 | 50-10 | 4800 | 80-50 | 0.06 | 24 |
| Teflon, vacuum | - | 1.E+6 | 80-50 | 4800 | 100-80 | 0.06 | 24 |
| RT/duroid (PFTE) | - | 1.E+6 | | | | | 22 |
| porous PTFE | 1.E+13 | 1.E+4 | | | | | 23 |
| Teflon | 3.E+14 | | 50-10 | | | | 15 |
| Teflon | | 2.E+6 | 60-40 | - | 2-6 | 0.25✕2 | 27 |
| Nylon | | 1.E+7 | | | | | 23 |
| Epoxy | | 1.E+8 | | | | | 23 |
| Polyethylene | | **>2.E+7** | | | | | 23 |

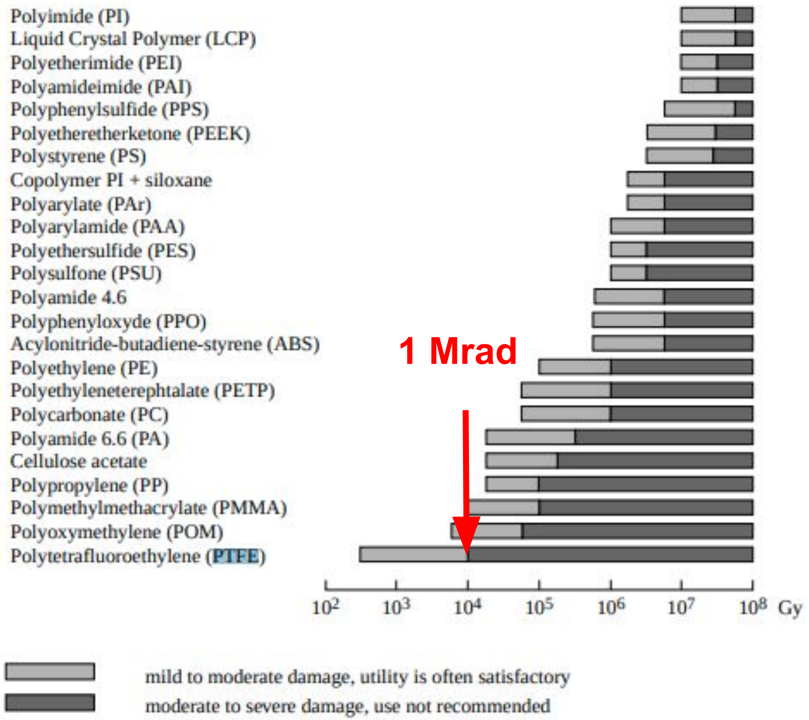
ebook: 10.5170/CERN-1998-001





**Table 2a**

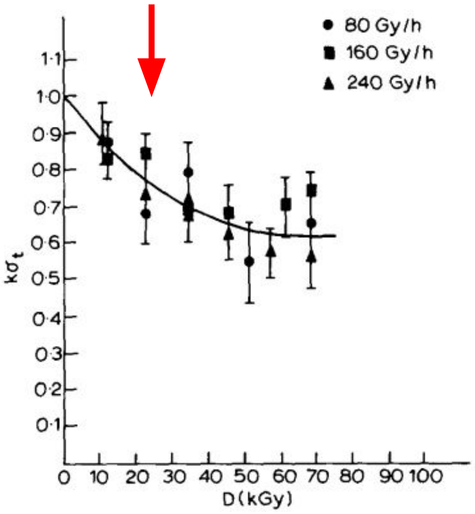
General classification of rigid thermoplastics with respect to their radiation resistance



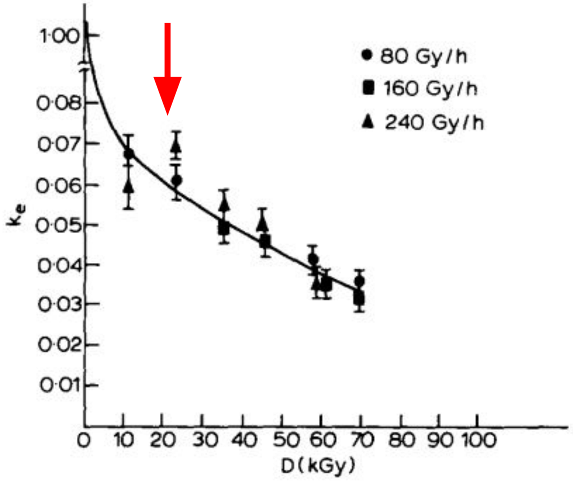
# Tensile strength of Teflon (cPTFE 6.4×50.1 mm) vs TID **in Air.**

**https://www.sciencedirect.com/science/article/pii/014139109290093K?via%3Dihub**

*M. I. Chipară*




Ratio of "tensile strength" of irradiated and unirradiated samples of cPTFE vs TID/kGy .




Ratio of the "elongation at break" for irradiated to that of unirradiated PTFE vs TID/kGy.

- At 20.E+3 Gy= **2.E+6 rad** Teflon sample Brakes at ~ 80% of nominal load, while elongates by ~6%.
- At 100 rad/hr (of $\gamma$) Teflon LT = 2.E+4 hrs.

# Tensile strength of Teflon (pPTFE 6.4×50.1 mm) vs TID **in Air.**

**https://www.sciencedirect.com/science/article/pii/014139109290093K?via%3Dihub**

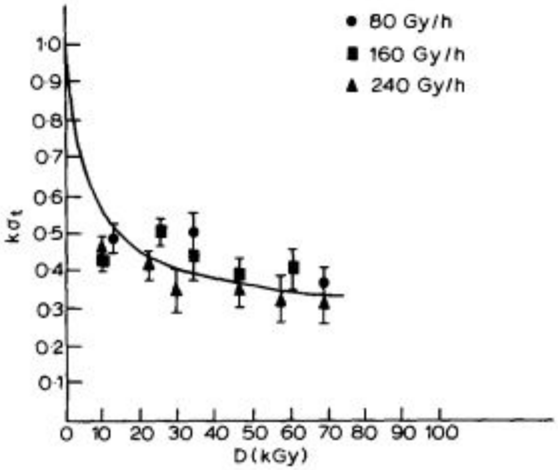



**Fig. 3.** The dependence of $K_{\sigma_t}$ on the doses, $D$, for pPTFE irradiated at various dose rates (80 Gy/h, 160 Gy/h, 240 Gy/h).

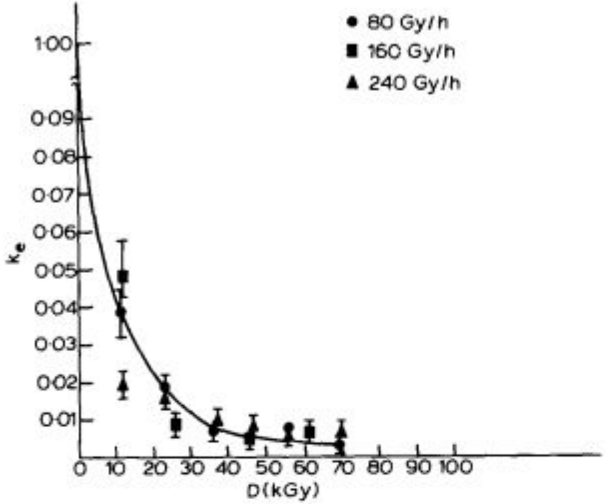



**Fig. 6.** The dependence of $K_e$ on the dose, $D$, for pPTFE irradiated at various dose rates (80 Gy/h, 160 Gy/h, 240 Gy/h).

- At 20.E+3 Gy= **2.E+6 rad** pure Teflon sample Brakes at ~ 45% of nominal load, while elongates by ~2%.
- At 100 rad/hr (of $\gamma$) Teflon LT = 2.E+4 hrs = 2.3 years.