

## Investigating the Effect of Natural Ageing on PBXN-109

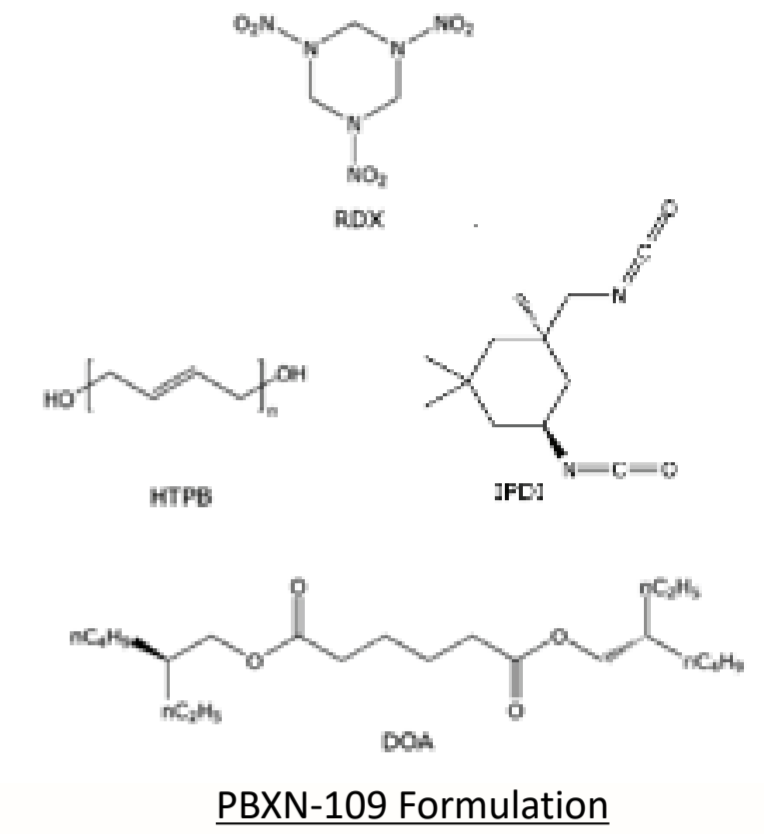
ME5 Tan Chow Tat  
Dr Nathalie Mai, Dr Guillaume

### Objectives:

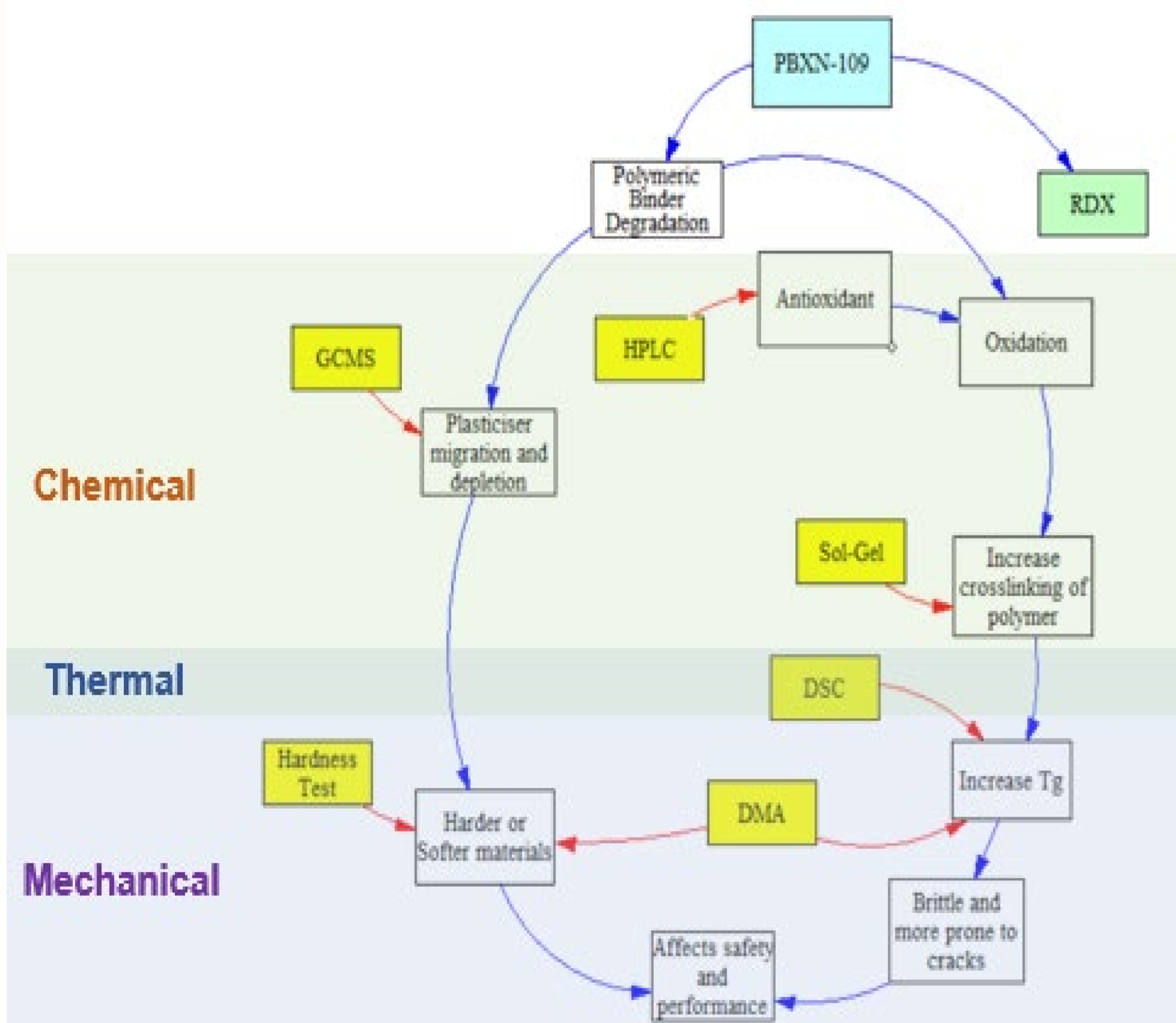
To assess the effect of natural ageing on PBXN-109. In particular, to assess the degradation effect through thermal, chemical and mechanical analysis.

### Research Ideas:

Polymer-Bonded Explosive (PBX) ages and degrades over time. The existing shelf-life assessment technique is carried out at high temperature (>60°C) and this might indirectly alter the energetics' properties. Therefore, it is essential to understand the actual natural degradation phenomenon to provide additional assurance on the predicted shelf life.

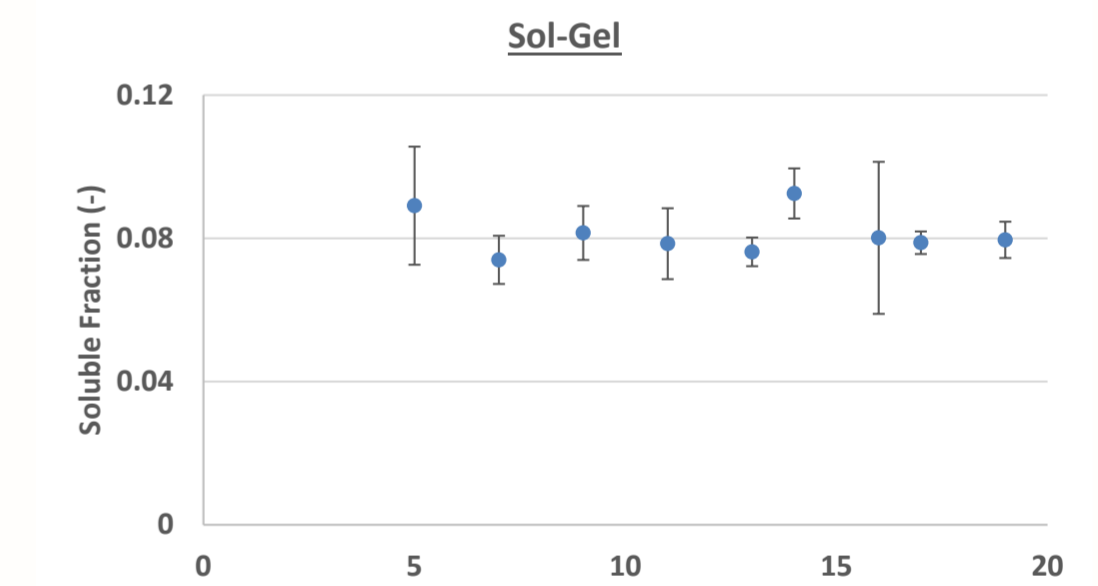
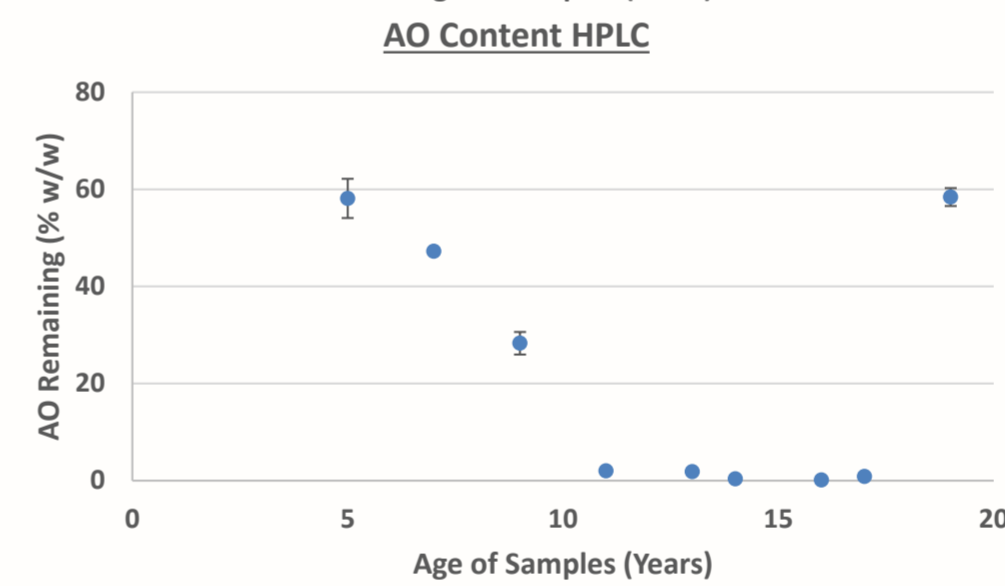
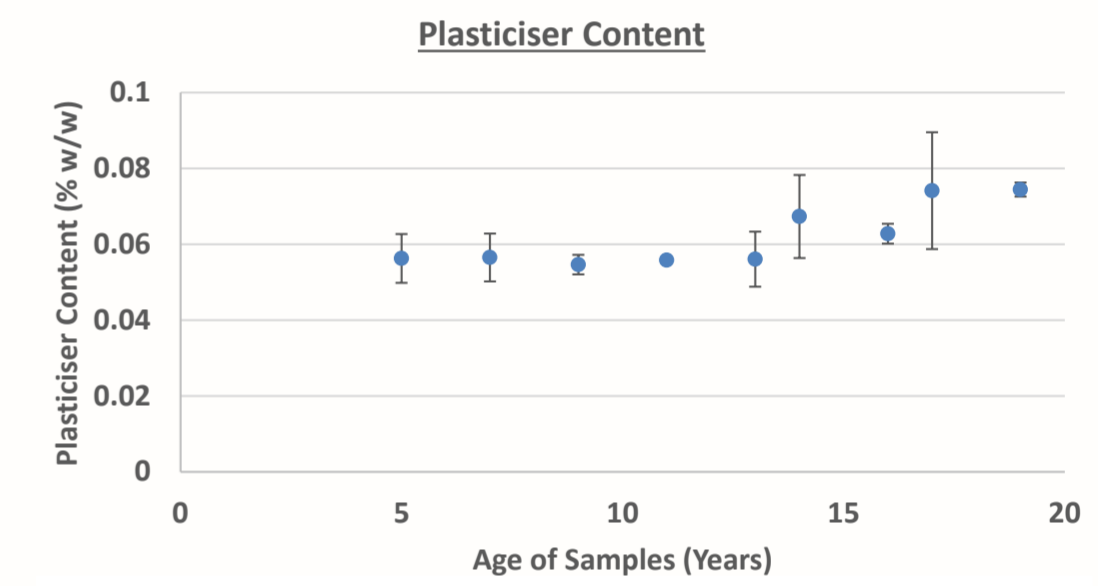
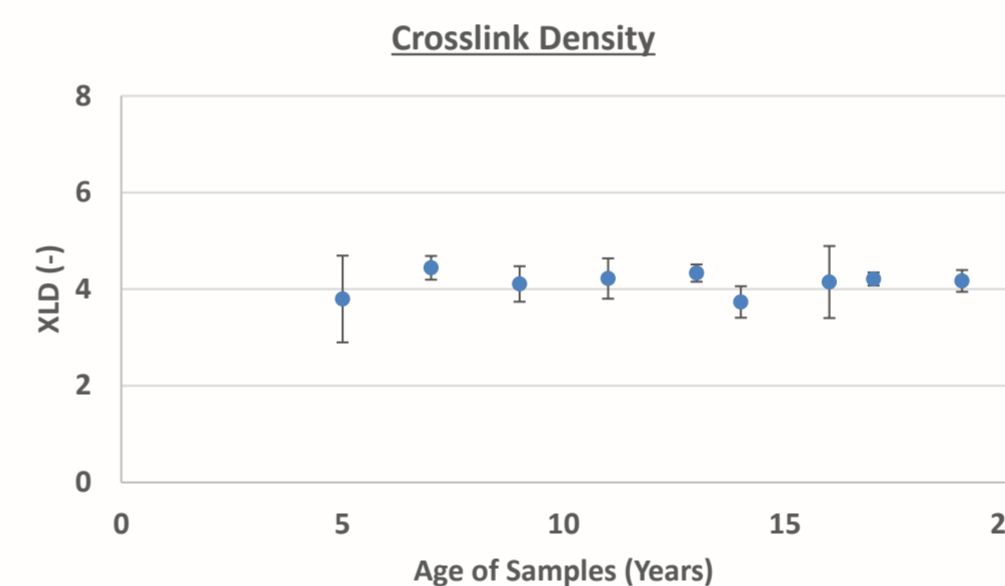


### PBXN-109 Degradation:

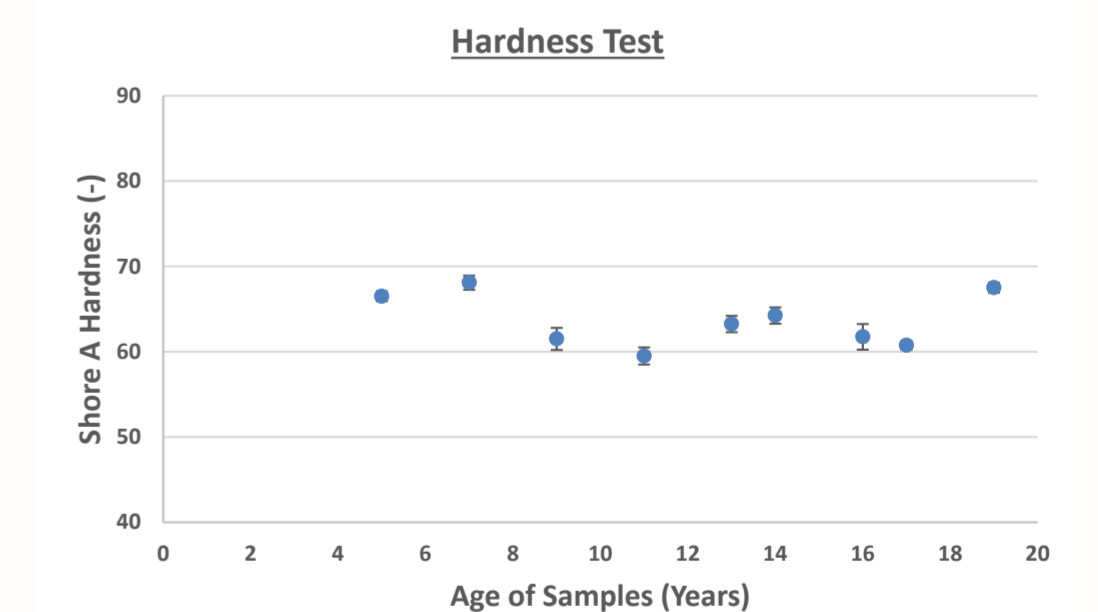
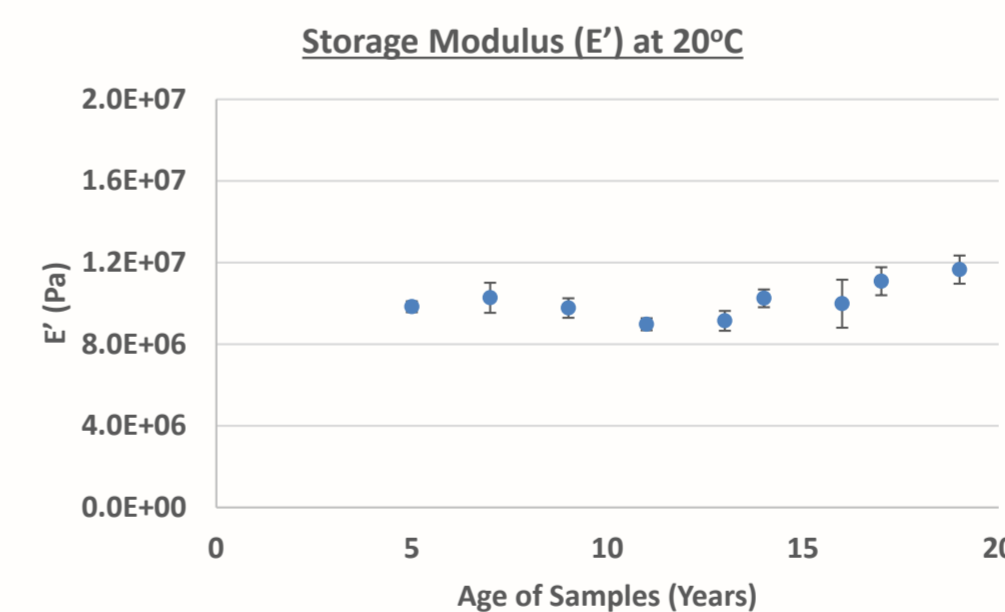


### Results:

#### Chemical & Thermal Test



#### Mechanical Test



### Conclusion:

1. Thermal, chemical and mechanical analysis shows **no signs of degradation** on the **naturally aged samples** (ranges from 5 to 19 years) → No significant changes to decomposition temperature, Tg, E', hardness, Sol-Gel and crosslink density
2. **AO** has been **effective** in performing its role to prevent degradation (i.e. oxidation) while **plasticiser** has shown little migration

### Future Work:

1. Conduct accelerated ageing trial on pristine sample → compare natural vs accelerated ageing
2. Conduct similar analysis on other location of the bulk sample → effect of diffusion
3. Conduct safety and performance tests (i.e. stability tests, shock sensitivity tests, IM tests)
4. Conduct similar analysis using energetics from the actual weapon system