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## Importance of Using Fully- Formulated Resins for Quality HDPE Geomembrane Manufacture

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# Introduction

- In some Asian countries HDPE geomembranes are produced by adding a stabiliser additive package to 'barefoot' resins (e.g. Marlex HHM TR400G from Chevron Phillips Singapore) rather than extruding the fully-formulated resin ('compounded resin' e.g. Marlex K306 or K307).
- However these systems require a completely different approach to the quality assurance system and testing protocols to ensure problems do not arise.
- Stabiliser masterbatches (e.g. M248\*) have to be added to this barefoot resin pre-geomembrane production as it is supplied without the necessary stabilisers to ensure long-term geomembrane performance.

\* Chevron Phillips Marlex® M248 LLDPE Carbon Black and Stabilizers Concentrate Masterbatch

# Geomembrane Producers

- Geomembrane producers are then responsible for controlling additive addition levels and dispersion. To achieve this they will need to use extruders with barrier screws specially designed to give good mixing and dispersion. Often geomembrane extrusion equipment does not have extrusion screws that impart sufficient shear and mixing to give good additive dispersion.

# Important Points to Consider

- In taking the barefoot resin and masterbatch route many issues have to be considered:
  1. Even if the barefoot PE material is a geomembrane resin it does not mean that the geomembrane made from the barefoot PE and a masterbatch is a compliant geomembrane. In some countries we have observed LDPE or LLDPE carriers are used to help disperse the additives which will inevitably dilute the geomembrane resin and result in a “blended” geomembrane. Also masterbatch carrier resins have been implicated in Separation-in-Plane failures.

# Important Points to Consider

2. Similarly if the starting resin passes the Geomembrane stress crack resistance criteria, the final geomembrane may not as the masterbatch carrier material may reduce the stress crack resistance of the blend.
3. Good dispersion of the pigment and additives is essential for long-term geomembrane performance. It is particularly difficult to disperse 2 – 2.5% carbon black without large agglomerates using a standard single screw extruder. These agglomerates may provide an initiation site for a crack which can cause premature failure of the geomembrane (see Figure 1).

# Poor Dispersion of Additives

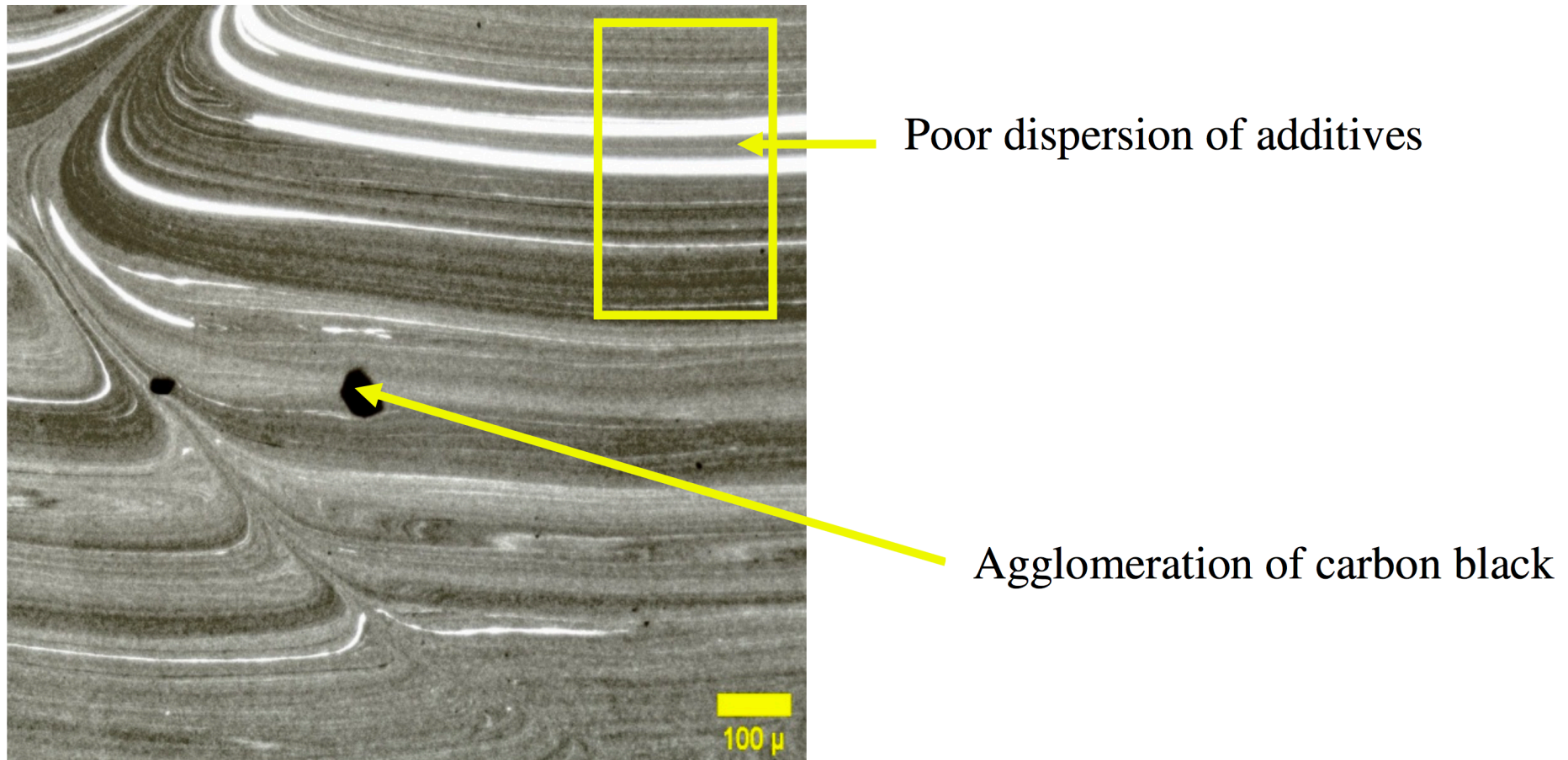
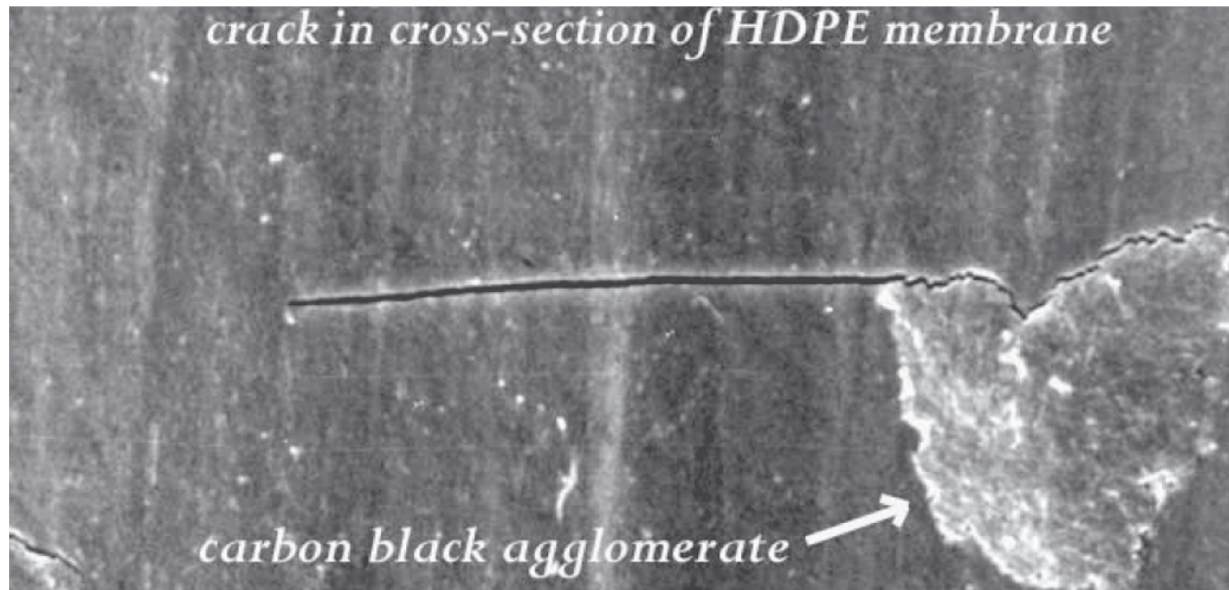


Fig.1. Poor dispersion of additives in polyethylene

# Important Points to Consider

4. To reduce agglomeration we have observed that some geomembrane producers reduce the amount of carbon black but this means that the UV stability of the geomembrane will be sacrificed as a minimum level of 2% is required to protect the geomembrane over its lifetime.
5. Also to help improve dispersion and reduce costs some use a carbon black with a larger particle size. This will also reduce the protection of the geomembrane as a carbon black with a particle size below 25 nm is required to achieve good UV stability (ref. Scheirs Geomembrane book p. 41 ).

# Crack Initiation from Carbon Black Agglomerates



Source: page 367, A Guide to Polymeric Geomembranes:  
A Practical Approach by John Scheirs (John Wiley & Sons)



# Important Points to Consider

6. The correct choice of additives also requires considerable knowledge and extensive testing to ensure that the finished product meets the long-term performance requirements for HDPE geomembranes in particular the retained S-OIT and HP-OIT after 90 day oven ageing. Poor additive dispersion can result in a failure to meet the required retained S-OIT and HP-OIT values after 90 day oven ageing.

7. Clearly when using the barefoot resin and masterbatch approach it is the geomembrane manufacturer who takes over the complete responsibility for the geomembrane quality since it is them that are in control of all the above critical items.

# Conclusions

- PE geomembrane compounds with a fully-formulated are usually produced on line using specialised equipment (such as twin-screw compounders) during the pelletisation process. This creates a consistent raw material to be used for quality geomembrane production thus providing important **“peace of mind”** for the geomembrane user and facility owner.

# References



## A Guide to Polymeric Geomembranes

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