Dynamic fracture characterisation of Dyneema composite
B.D. Heru Utomo
Faculty of Mechanical, Maritime and Material Engineering
Mechanics of Materials
TU Delft, Mekelweg 2, NL 2628 CD Delft
Tel: +31-(0)15-278 6512, e-mail: b.d.heruutomo@tudelft.nl

Introduction
Dyneema is used in many applications such as ropes, sports equipment, gloves and armour applications in for example helicopters, see figure 1. When Dyneema is used in armour applications, fracture phenomena occur due to projectile impact. A good understanding of fracture phenomena is required for further development.

Objective
This study aims at obtaining good understanding of the fracture phenomena that occur in Dyneema composite panels due to projectile impact.

Methods
Dyneema mainly consists of fibre material that is embedded in a small amount of rubber matrix. Experiments are done both on Dyneema fibres as on Dyneema composite. Projectile impacts with different velocities are recorded using high speed photography, see figure 2. After the (impact) experiments, the material is analysed using microscopic and surface scanning techniques.

Results
Delamination and other fracture phenomena depend on different parameters and their interactions [1]. The delamination area of Dyneema composite panels depend on the velocity, see figure 3.

The shape of the delaminated varies. This is ascribed to manufacturing parameters. An example is shown in figure 4.

Future work
Fracture phenomena depend on more than projectile velocity alone. It also depends on projectile geometry, process conditions. These factors should also be analysed in the future to obtain a full understanding of fracture phenomena due to projectile impact.

References

Figure 1: gloves, rope, and helicopter

Figure 2, high speed images of projectile impact on fibre (left) and composite (right)

Figure 3: Amount of delamination as a function of impact velocity

Figure 4: Delamination areas at different impact velocities