PE Aluminium Composite Material
The Issue of Combustibility

In bygone years, a significant factor in the selection of building materials was the notion that, if it was built right, it would stand the test of time.
The quality of the end result was to be a reflection on the tradesmen themselves, their workmanship and most importantly, their reputation.
As times, technologies, the environment and some practises change, one fact remains unchanged: Reputations develop over many years of hard work however they can be undone overnight due to poor choices, short cuts and false economies.

> ***"We shape our buildings; thereafter they shape us"***
> **Winston Churchill**

The Issue of Combustibility

While there is fuel for a fire, experience has allowed us to understand that it can very easily spread from floor to floor, through and over facades and the result can be nothing short of catastrophic. Compliance and regulatory test based methods to address the behaviours of fires in facades (and for different façade systems) vary considerable from country to country, and even from state to state.

Without Question, a fire hazard is more severe if the components of the façade system are combustible and/or incorrectly installed. Recent fire incidents in Victoria have demonstrated the rapid and extensive fire spread over the façade, both externally and internally through the insulation cavity.

Common use of combustible exterior façade materials can include:

- Exterior Insulation Finish System (EIFS)
- High Pressure Laminates
- Structural Insulation Panel Systems (SIPS)
- Weather Resistive Barriers (WRB)
- External Timber Panelling
- PE Aluminium Composite Material (ACM)

The Danger

It is an accepted and proven fact that the key initiating factor can be one of two possible fire types:

1. Fires external to the building (such as other burning construction, external ground fires)
2. Fires internal to the building, originating in a floor/ceiling that has resulted in breaching the external wall (breaking windows) and spreading to the façade

Key Mechanisms of fire spread after an initiating event include:

1. Fire spread to the interior of the level above via openings such as windows causing secondary interior fires resulting in level to level fire spread (leap frogging)
2. Flame spread over the external surface of the wall if combustible
3. Flame spread within an internal vertical cavity / air gap or internal insulation layer. This may include possible failure of any fire barriers if present, particularly at the junction of the floor with the external wall
4. Heat flux impacts causing degradation / separation of non-combustible external skin (los of integrity) resulting in flame spread of internal core
5. Secondary external fires to lower levels or ground floor arising from falling debris or downward fire spread

Research has established that the façade fire safety problem can be segmented into four parts:

1. Specification of fire exposure scenario and the heat flux distribution both inside and from the façade flames originating from the fire within. This requirement is a pre-requisite for the following parts
2. Fire resistance of the façade assembly and façade-floor slab junction, including structural failure for both non-combustible and combustible façade assemblies
3. Fire spread on the external surface of the façade if combustible due to the flames from the enclosure fire
4. Fire spread and propagation inside the façade insulation, if combustible, due to the enclosure fire.

Fire incidents involving exterior facades worldwide have been reviewed and revealed that although exterior façade fires are low frequency events, the resulting consequences both in terms of fire spread and also property loss can potentially be very high. For most of the incidents reviewed, the impact on life safety in terms of death is relatively low with the main effects due to smoke exposure rather than to the direct flame or heat. This does not negate the danger to the life of the occupants and the extreme risks faced by those entrusted to fight the fire itself, this is particularly been the case for incidents in countries with little or no regulatory controls on combustible exterior walls or where construction has not been in accordance with regulatory controls.

The fire in the 23 storey Lacrosse apartment block in Docklands raises many serious questions, given that we are a wealthy, first world country with stringent, highly developed construction standards and established compliance requirements:

"How does this happen in Australia?"

To understand the cause(s) and contributing factors of this fire we need to better understand:

- What is an ACM?
- What is a 'fire retardant" ACM?
- What are the relevant compliance requirements (BCA)?
- Our collective responsibility

What is an ACM?

An Aluminium Composite Material or ACM is a generic reference describing a flat panel that consists of a mineral core bonded between two aluminium sheets which many vary from 0.3-0.5mm in thickness. The core is typically a low density material that often incorporates polyethylene (PE) as the major component. Polyethylene is a hydrocarbon based combustible material. The predominant use of hydrocarbon is as a combustible fuel source, consequently, in addition to being a fire hazard (due to its combustibility), an ACM with a PE core is prone to melting, dripping and collapsing.

It is widely acknowledged (and recommended by responsible manufacturers/distributors) that the application of Polyethylene ACM should be restricted to display signage, provided it is not directly attached to the building.
In essence PE is a plastic which inevitably burns extremely quickly when exposed to an open flame. This results in PE droplets forming and dripping causing the panels to ignite from the bottom up and eventually burning its way through the façade.

Polyethylene and Cigarette Butts don't mix

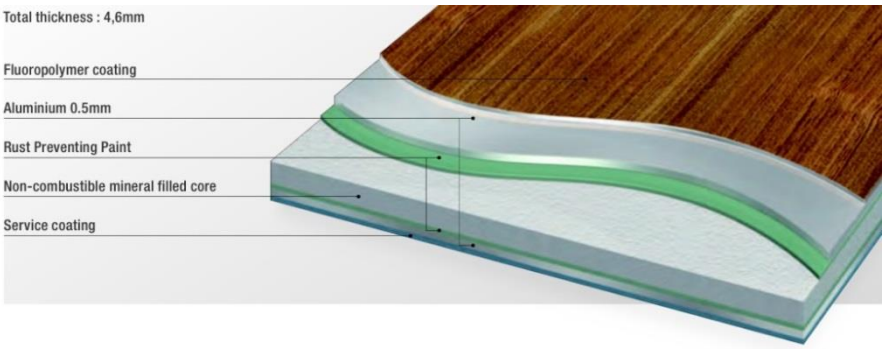
Tamweel Tower, Dubai -2012

Tamweel Tower is a 34 storey mixed use / residential building located in Jumeirah Lakes, Dubai.
The building was clad with metal composite panels consisting of aluminium with a polyethylene core, the building also used the metal composite cladding as a decorative feature on the rooftop.
On 18th November 2012 at approx. 1:30am a fire started on the ground level as a result of a cigarette butt getting discarded into construction waste materials. This fire quickly spread up the exterior of the building, igniting much of the façade.

Based on the photos and videos available it appears that the upward fire spread was at least partially due to the molten flaming debris from the cladding falling onto lower level balconies and igniting the façade at these levels. Thankfully there were no reported fatalities.

As at the end of February 2015, repair work was 'apparently' set to begin in a few months, more than 2 and a half years after the incident.

What ACM products are really non-combustible?



Whereas polyethylene core ACM is a 100% combustible material, replacing it with Aluminium Hydroxide into the core material negates the combustibility classification (through specific testing/compliance). Aluminium Hydroxide is the chemical that is added to cement in order to create concrete products. Cement with high Aluminium content will dry quicker, particularly when subjected to heat. When Aluminium Hydroxide is mixed with Polymers it makes an excellent fire retardant, consequently whilst **the polyethylene core will promote 'heat generation', the alumina hydroxide core will result in 'heat absorption'. This is the fundamental difference between PE and "fire retardant" core.**

It is important to understand that "fire retardant" ACM's are constructed using a wide variety of materials and methods and as a result they do not all perform in the same way in relation to fire. To assist identification of fit-for-purpose ACM cladding, the current CodeMark Certificates disclose their non-combustible component. This is a major advancement in the area of transparency as all material components will be assessed independently and without embellishment.

The highest non-combustible "fire retardant" ACM in the market is Alpolic/fr (80%).

ACM and the BCA

For a system/product to be compliant it needs to meet "Deemed to Satisfy" (DtS) conditions set out in the BCA, as a building solution. A system/product that is not DtS is classified as "non-DtS" and can only be considered further as an "Alternative Solution".

Most commonly, an ACM is considered as part of an 'Alternative Solution" where the Performance Requirements are verified by one/more of the following:

- CodeMark Certificate of System Conformity (National)
- Judgement Report from a recognised industry expert (building surveyor excluded)
- Reports from a Registered Tendering Authority
- Accreditation Certificates (Building Commissions)

A list of CodeMark Certified products/systems is made available through the website of the Australian Building Codes Board (ABCB):
http://www.abcb.gov.au/en/product-certification/codemark/list-of-codemark-certified-products.aspx

Maintaining Your Specification Integrity

The responsibility of ensuring that the materials, form of construction and the design meets the Performance Requirements of the BCA rests with all those involved in the building process. The consequences of failing to adhere to these compliance requirements carry repercussions of the most serious nature.

With the evidence of the fire problem being undeniable and the identification of the associated risks being alarming, what are the moral and legal obligations?

The Architect

- Diligent research to select/discover 'fit-for-purpose' materials
- Collaborate with supplier to ensure appropriate preparation of specification
- Identify key performance standards in order to discourage substitution for inferior materials
- Consider safety at all times

> "Noble life demands a noble architecture for noble uses of noble men.
> Lack of culture means what it has always meant: ignoble civilization and therefore imminent downfall"
>
> *Frank Lloyd Wright*

The Head Contractor

- Ensure commitment to risk minimisation and compliance
- Adhere to the specification, offering substitution without compromising performance and safety
- Take ownership/accountability for the "end product"
- Consider present and future safety at all times

The Sub Contractor

- Substantiate cost savings without reducing safety/performance
- Ensure best practise installation methods applied at all times
- Consider present and future safety at all times

The Supplier

- Provide full disclosure with performance/compliance information
- Investment to deliver more advanced technology options
- Ethical and responsible business practices
- Consider present and future safety at all times

Without doubt, economic pressures have given way to questionable decision making and short sightedness when it comes to cost cutting which has, in most if not all case, proven to be false economic reasoning. This has to a great extent, aided and abetted the influx on non-compliant building materials which has compromised safety and performance as evidenced in the Docklands catastrophe.

SGI "Specify with Confidence"

As the market leader, SGI Architectural has been at the forefront of innovation in relation to composite façade material design, efficiencies and safety.
In recognising the dangers and unsuitability of PE core for construction applications, SGI accepted the corporate and social responsibility of providing the market with the highest performing non-combustible ACM. Since 2000, the entire Alpolic range across all colour selections has been upgraded to fire retardant core in lieu of PE.

Additionally, we maintain strict systems and processes that facilitate:

- All orders cross referenced by project name/location
- All orders identified by production batch numbers
- A network of authorised & approved Alpolic fabricators and installers
- Issue of factory warranty documentation