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冰雹冲击下温室玻璃破损情景数值模拟

### Numerical simulation on damage behavior of greenhouse glass under hail impact

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中文摘要:

为研究温室玻璃的抗冰雹冲击性能, 该文采用ANSYS/LS-DYNA软件建立了温室玻璃和随机冰雹的有限元模型。考虑冰雹的随机性, 模拟了冰雹冲击温室玻璃的全过程; 得到了不同粒径冰雹对温室玻璃的破损效果; 研究了冰雹对不同厚度、不同平面尺寸、不同支撑情况的温室玻璃的破损效果; 同时, 对温室玻璃的抗雹性能进行了评估。结果表明: 玻璃板受冰雹群冲击时的破损效果不等于单个冰雹冲击时的简单叠加; 4 mm厚的玻璃板基本可以满足大部分玻璃温室的抗雹要求; 温室玻璃板长宽比值建议在1.5左右; 通过控制玻璃板支撑条件来提高温室玻璃板的抗冲击性能并不可靠; 保证冰雹冲击时玻璃板的整体稳定性, 使主体结构不出现大跨度裂纹而形成较大碎片, 应是玻璃温室抗雹设计的主要目标。该研究可为温室抗冰雹设计提供参考。

英文摘要:

In order to analyze hail resistant behavior of greenhouse glass, the numerical simulation on the overall process of random hail impacting greenhouse glass were carried out by using finite element analysis software ANSYS/LS-DYNA with consideration of hail randomness. The failure modes of greenhouse glass under the impact of hail with different diameter were obtained. And also the failure modes of greenhouse glass with different thickness, different plane size and different constraints under the impact of hail were discussed respectively. At the same time, hail resistant behavior of greenhouse glass was evaluated. The results showed that the effects due to hail flock impacting glass plate was not equal to that due to single hail impacting glass plate. Glass plate 4 mm in thickness could nearly meet the hail resistant requirements of most glass greenhouse. It's suggested that ratio of glass plate length to its width were about 1.5. It was not reliable to improve the hail resistant behavior of greenhouse glass by regulating glass plate constraints. It should be the main aim of hail resistant design of glass greenhouse to ensure the global stability of glass plate under the impact of hail and no large cracks or debris. The fruits were useful to the hail resistant design of greenhouse.

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