Advanced Methods in Modeling

Dislocations and V-shaped Pits in InGaN MQW LED

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Introduction: effects of V-pit dislocation

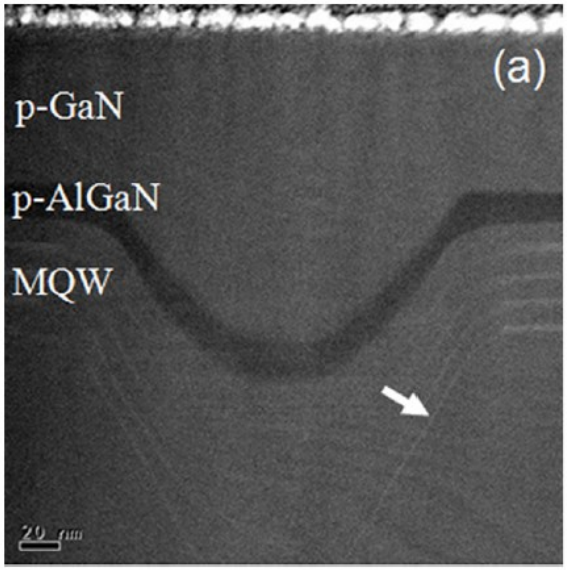
Distortion of MQW makes the QW width smaller and effective bandgap larger at the pit.

Emission at shorter wavelength at the V-pit.

Expulsion of electrical current away from the V-pit to suppress non-radiative recombination of LED.

Appl. Phys. Lett. **102**, 251123 (2013)

251123-2 Han *et al.*



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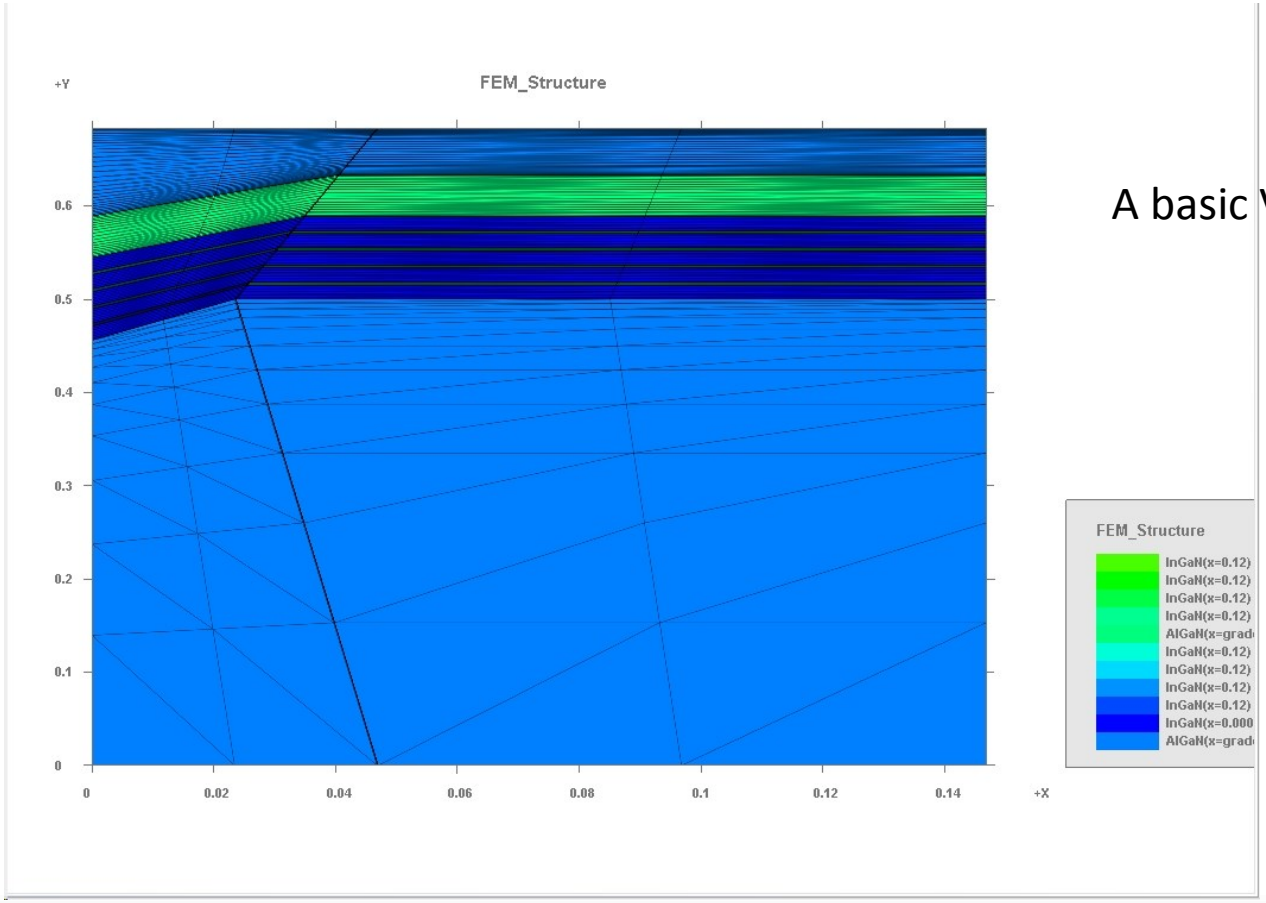
Upgraded LayerBuilder (Ver. 2015 or later)

Makes it easy to set up mesh for the MQW within the V-pit without compromising celebrated models such as quantum transport, quantum confinement, k.p-based band structure, radiative recombination models, etc…



A basic V-pit example.

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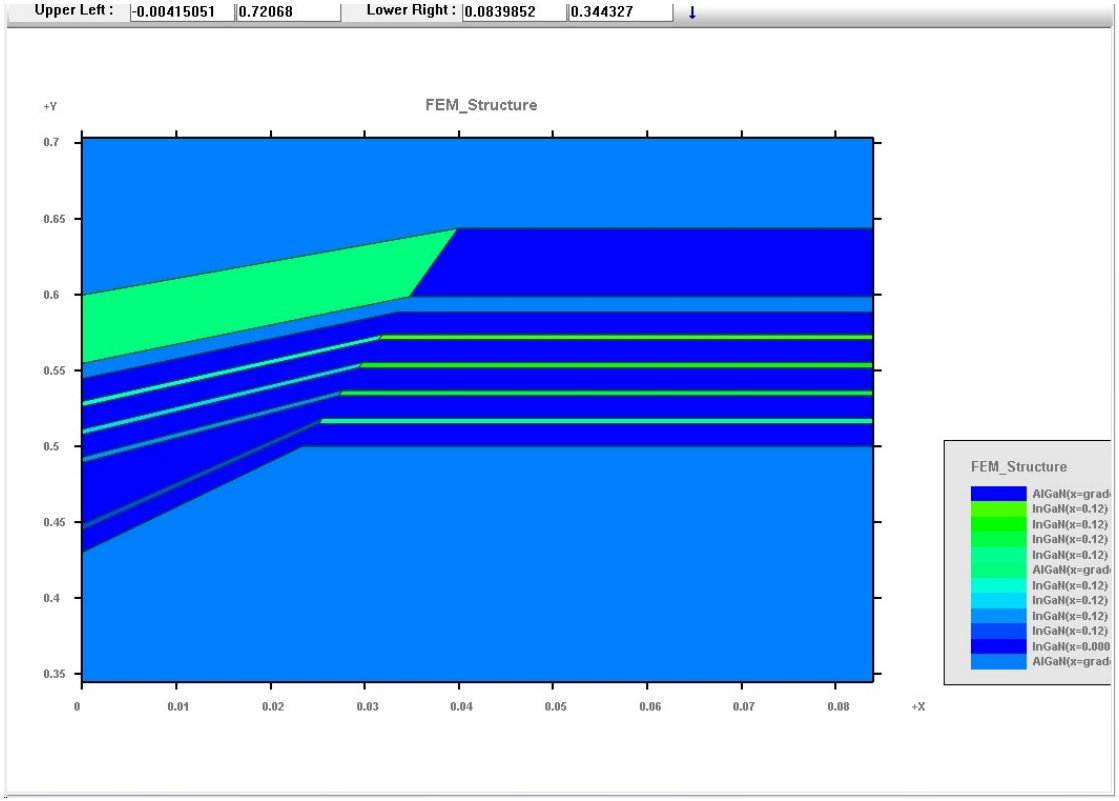
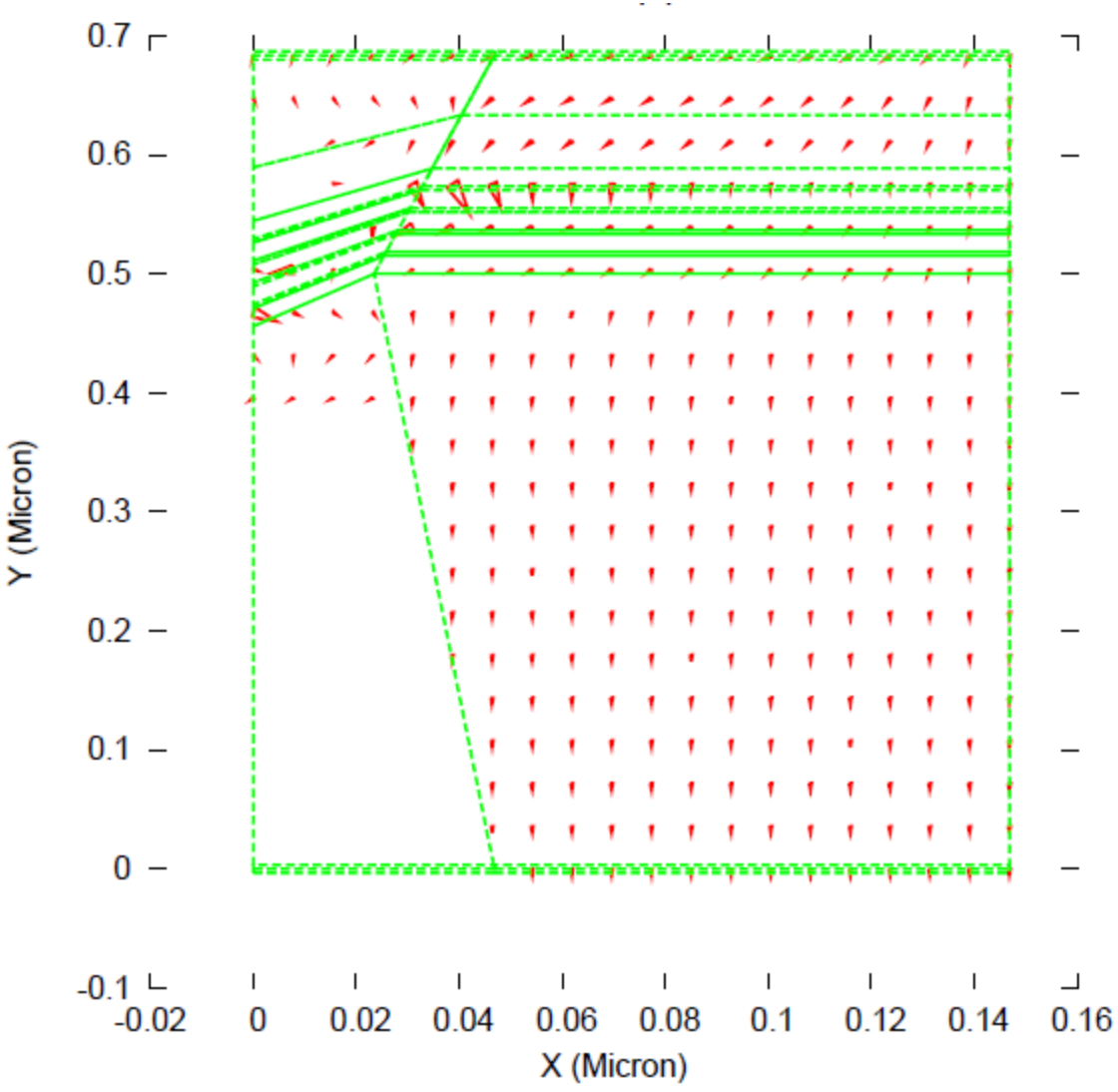
A more complicated V-pit example

It is possible to use multiple columns to construct a V-pit with smooth shape.
Also possible to use CSUPREM to deposit and etch to form such shapes.



Distribution of current flow:



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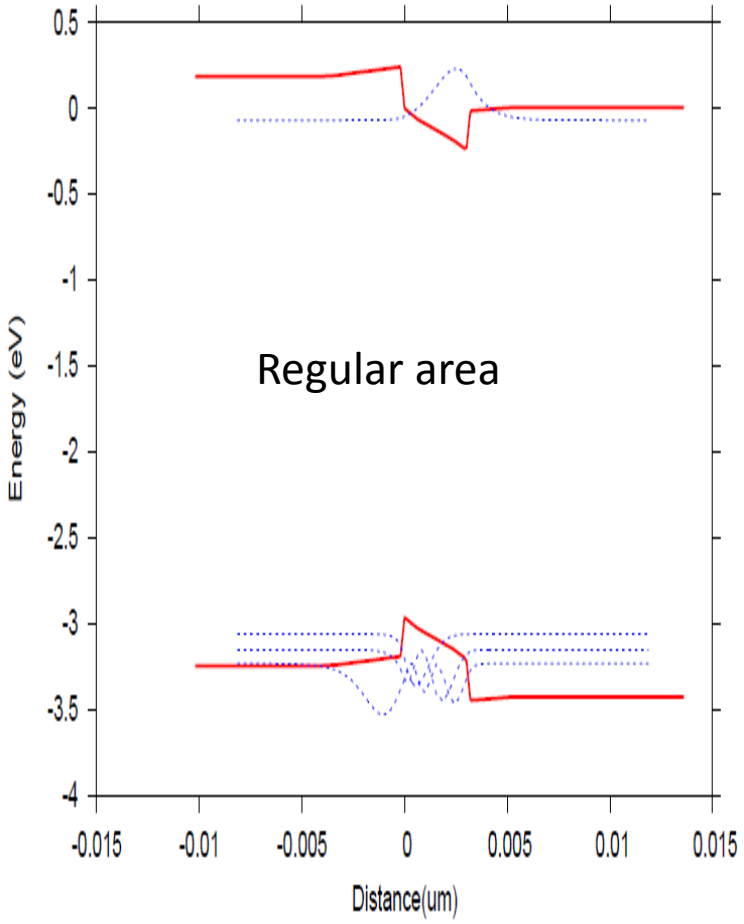
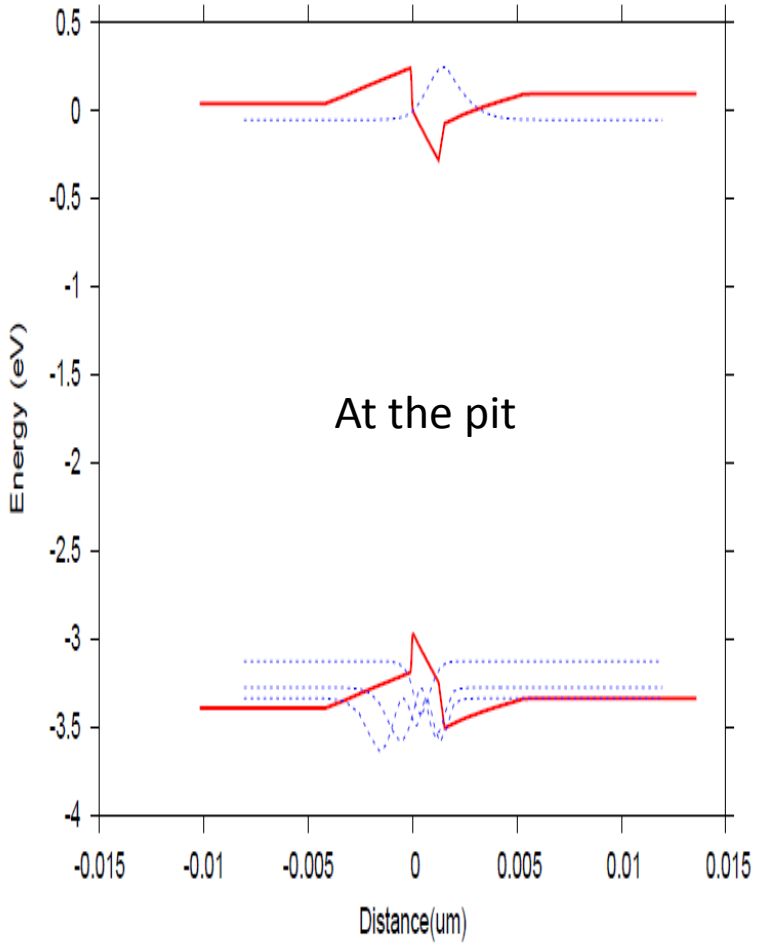
Different quantum confinement at the pit





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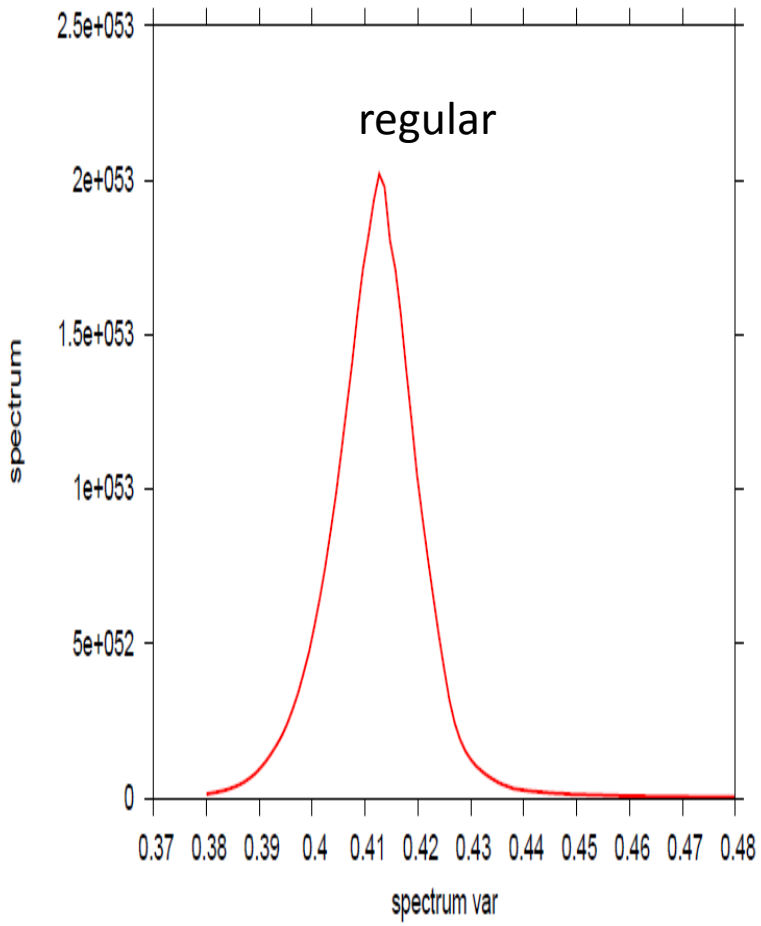
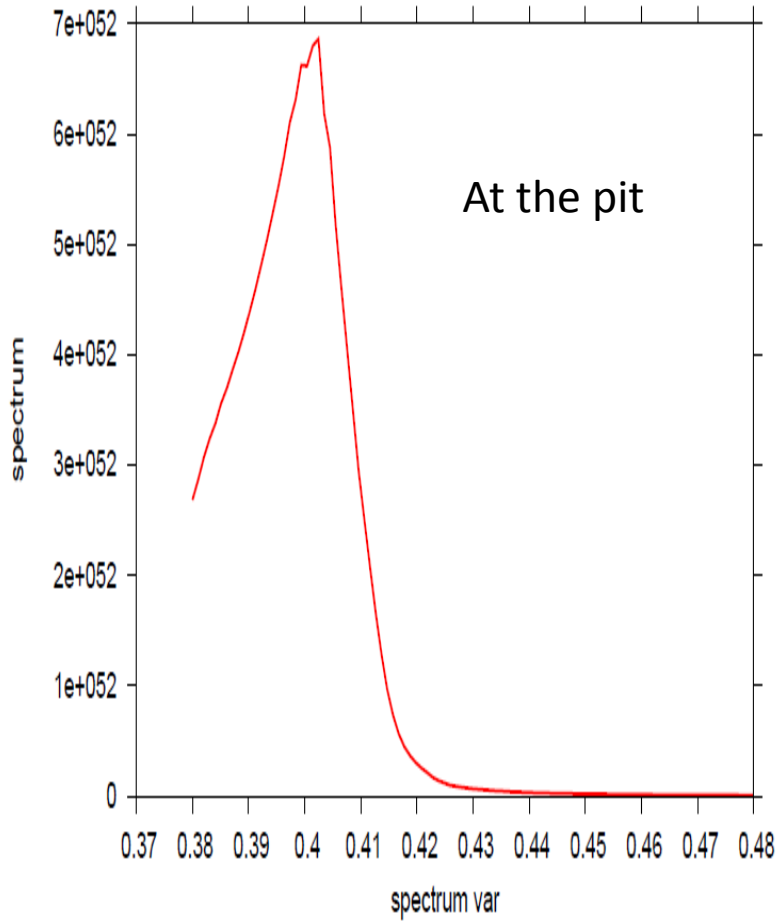
Different spectrum at the pit





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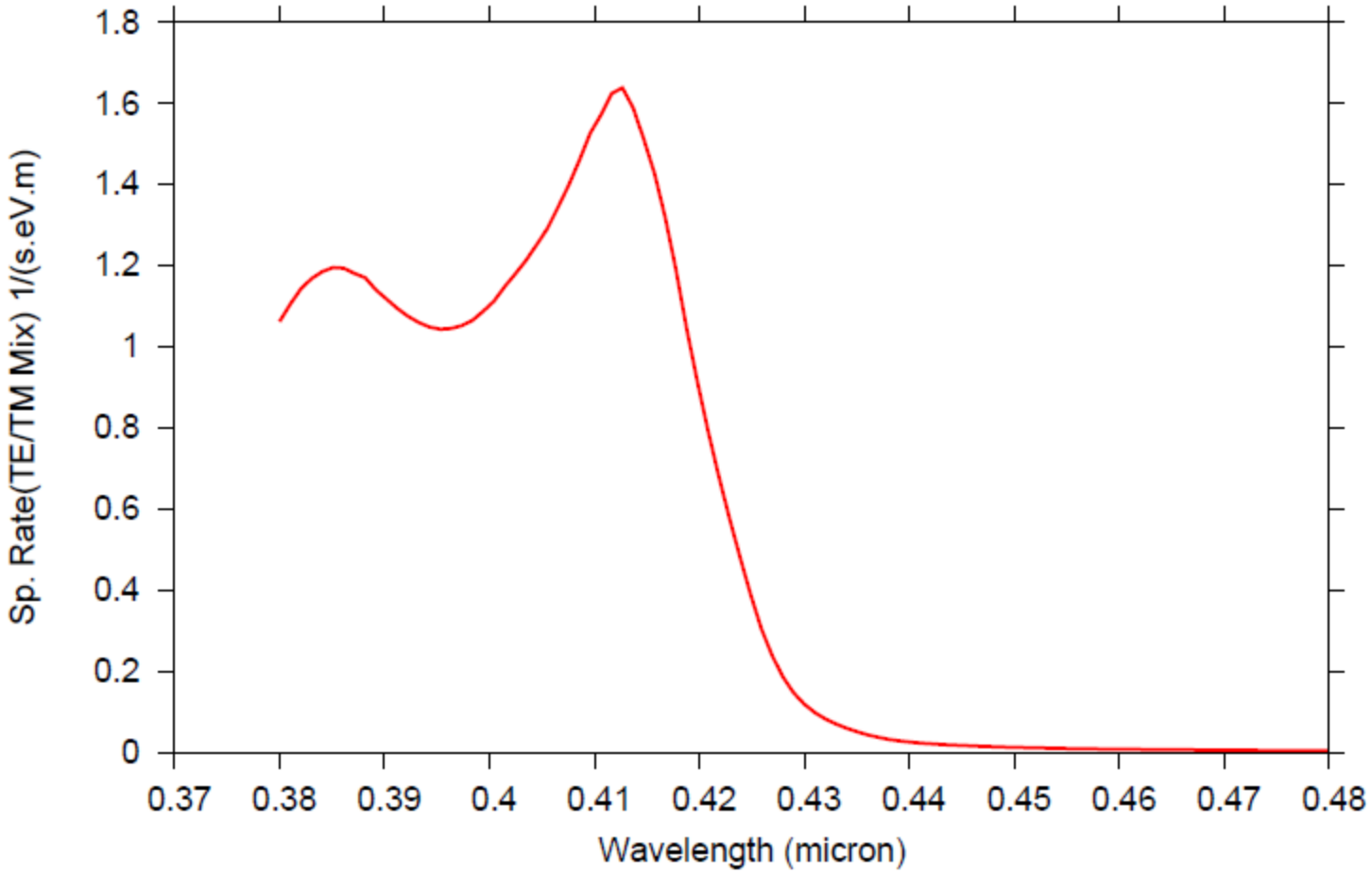
Composite LED spectrum for the simulated area



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Summary

More sophisticated model of dislocations with ver. 2015 and later.

All advanced MQW models carried over to QW with arbitrary orientation.

Very convenient to build V-pit using upgraded LayerBuilder.

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