World Academy of Science, Engineering and Technology
International Journal of Nuclear and Quantum Engineering
Vol:15, No:06, 2021

The Role of Metal-Induced Gap States in the Superconducting Qubit Decoherence at Low-Dimension

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Abstract : In the present communication, we analyze selected local aspects of the metal-induced gap states (MIGSs) that may be responsible for the magnetic flux noise in some of the superconducting qubit modalities at low-dimension. The presented theoretical analysis stems from the earlier bulk considerations and is aimed at further explanation of the decoherence effect by recognizing its universal character. Specifically, the analysis is carried out by using the complex band structure method for arbitrary low-dimensional junctions. This allows us to provide the most fundamental and general observations for the systems of interest. In particular, herein, we investigate in detail the MIGSs behavior in the momentum space as a function of the potential fluctuations and the electron-electron interaction magnitude at the interface. In what follows, this study is meant to provide a direct relationship between the MIGSs behavior, the discussed decoherence effect, and the intrinsic properties of the low-dimensional Josephson junctions.

Keywords : superconducting qubits, metal-induced gap states, decoherence, low-dimension
Conference Title : ICQIE 2021 : International Conference on Quantum Information and Electronics
Conference Location : Paris, France
Conference Dates : June 24-25, 2021